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PRESTON

GEODESEY

ON THE VARIATION
OF LATITUDE AT
WAIKIKI

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Revised edition

UNITED STATES
COAST AND GEODETIC SURVEY

14

T. C. MENDENHALL
SUPERINTENDENT

GEODESY

ON THE VARIATION OF LATITUDE

AT WAIKIKI; NEAR HONOLULU

HAWAIIAN ISLANDS

FROM OBSERVATIONS MADE IN COOPERATION WITH

THE INTERNATIONAL GEODETIC ASSOCIATION

1891, 1892

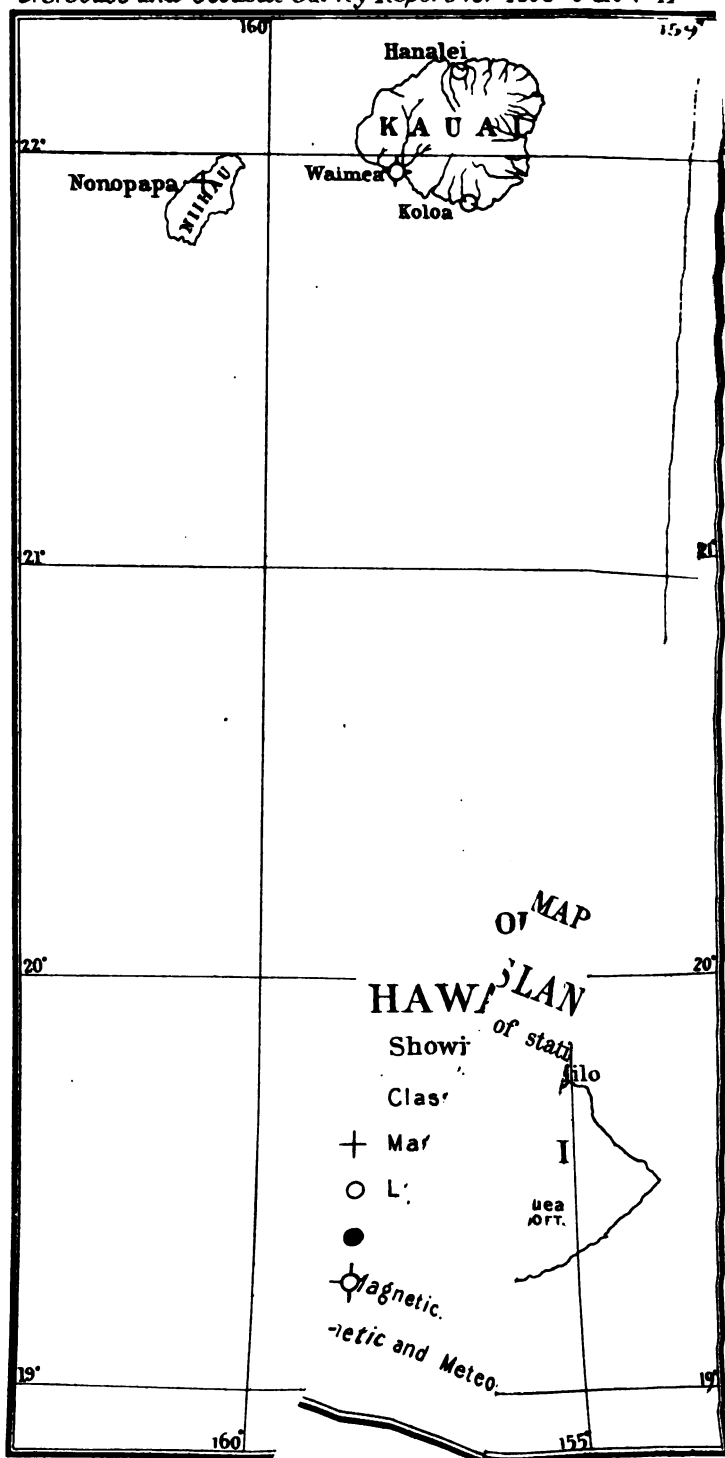
revised edition
By E. D. PRESTON, Assistant

APPENDIX No. 2—REPORT FOR 1892



WASHINGTON
GOVERNMENT PRINTING OFFICE
1893

U.S. Coast and Geodetic Survey Report for 1892 Part II



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APPENDIX NO. 2—1892.

ON THE VARIATION OF LATITUDE AT WAIKIKI, NEAR HONOLULU,
HAWAIIAN ISLANDS, AS DETERMINED FROM OBSERVATIONS MADE
IN 1891 AND 1892 IN COÖPERATION WITH THE INTERNATIONAL GEO-
DETTIC ASSOCIATION.

A report by E. D. PRESTON, Assistant.
Submitted for publication, May 15, 1893.

In compliance with the instructions of the Superintendent, there
were made in the Hawaiian Islands, between May 8, 1891, and Sep-
tember 14, 1892, the following observations:

- I. Of the transit of Mercury on May 9, 1891.
- II. Of the variation of latitude from June 6, 1891, to June 25, 1892.
- III. Of the force of gravity on Oahu and Hawaii from June 9, 1891, to July 25, 1892.
- IV. Of the magnetic elements at fourteen stations at intervals from August 11, 1891, to September 9, 1892.
- V. For latitude on the island of Hawaii at the base, on the flank, and at the summit of Manna Kea, from July 4, 1892, to July 25, 1892.
- VI. Of meteorological phenomena, including the barometric determination of the height of Mauna Kea (nearly 14,000 feet), from July 1, 1892, to July 27, 1892.

Illustration No. 5 shows the location of these stations, as well as of those that had been previously occupied for scientific observations under the direction of Prof. W. D. Alexander, the Surveyor-general of the Hawaiian Government.

The following table gives a summary of the season's work:

Summary of observations in the Hawaiian Islands in 1891-'92.

Station.	Island.	Date of occupation.	Class of observations.	Nights or days of observations.	No. of determinations.	Remarks.
Waikiki.	Oahu.	1891.				
		June 6-June 25	Latitude.	220	2434	
		June 9-June 11	Gravity.	199	827	
		June 9-June 11	Time.	202	202	
Kahuku.		1891.				
		Aug. 11-Aug. 13	Magnetic.	3	3	
		Nov. 25-Nov. 27	do.	3	3	
Honolulu.		1892.				
		June 23-June 25	Gravity.	3	57	
		June 15-June 27	Time.	10	10	
Kawaihae.	Hawaii.	June 2-June 4	Magnetic.	3	3	
		July 4-July 6	Latitude.	3	23	
		July 3-July 6	Gravity.	4	91	
		July 3-July 6	Time.	4	4	
		July 1-July 3	Magnetic.	3	3	
Waimea.		June 30-July 7	Meteorology.	8		
		July 8	Magnetic.	1	1	West base.
		July 9-July 11	do.	2	2	Old station.
Kalaieha.		July 7-July 11	Meteorology.	5		
		July 14-July 15	Latitude.	2	3	
		July 14-July 16	Gravity.	3	67	
		July 14-July 18	Time.	6	6	
		July 14-July 16	Magnetic.	3	3	
Waiau.		July 13-July 18	Meteorology.	6		
		July 21-July 25	Latitude.	4	55	
		July 22-July 25	Gravity.	4	81	
		July 21-July 25	Time.	4	4	
		July 21-July 24	Magnetic.	3	3	
Hilo.		July 21-July 26	Meteorology.	6		
		July 30-Aug. 3	Magnetic.	5	3	
		Aug. 18-Aug. 21	do.	4	3	
		Aug. 23-Aug. 25	do.	3	3	
		Sept. 2-Sept. 3	do.	2	2	Latitude station, 1887, and transit of Venus, 1874.
Nonopapa.	Niihau.	Sept. 5-Sept. 6	do.	2	2	Thorny Croft.
		Sept. 9	do.	1	1	

In the column "Number of determinations" the figures indicate: For latitude, the number of pairs of stars observed. For gravity, the number of intervals, each one giving a value for the period of oscillation of the pendulum. For time, the number of sets of stars, each one giving a correction to the chronometer. For terrestrial magnetism, the number of determinations of all three elements, declination, dip, and horizontal intensity, and the time and azimuth.

The meteorological observations were made many times during the day. The barometer was read at the times of maximum and minimum—at 9 a. m. and 3 p. m. On the summit of Mauna Kea it was read more frequently.

The National Academy of Sciences, the United States Coast and Geodetic Survey, and the Hawaiian Government have each contributed to the accomplishment of this work. The first named supplied the

On the variation of latitude at Waikiki, Hawaiian Islands.

funds for the prosecution of the international latitude observations, our own service furnished the instruments and observer, and the Hawaiian Government survey defrayed most of the expenses for the gravity and magnetic determinations. I left Washington on April 18, 1891, and returned on October 16, 1892.

The results of the observations of the transit of Mercury have already appeared as Appendix No. 12 of the Report of the Superintendent for 1891, Part II.

It is proposed in the present paper to deal with the international latitude observations only, reserving the last four heads for a subsequent report. This work was undertaken at the request of the International Geodetic Association. The following extract from a letter written by Prof. Helmert to the Superintendent of the Coast and Geodetic Survey, under date of October 18, 1890, refers to our coöperation, gives reasons for sending two observers, and specifies the conditions necessary for successful work:

. . . Da die Geldmittel der permanenten Commission etwas beschränkt sind, so ist beschlossen die Expedition nur auf 1 Jahr auszudehnen, wovon 2 Monate auf die Reise und 10 auf Beobachtungen kommen. Auch kann 1 Beobachter (Dr. Marcuse bisher in Berlin Beobachter) und nur 1 Instrument ausgesandt werden. Die hiesigen Erfahrungen haben aber gezeigt, dass sehr leicht in einer Reihe durch Krankheit des Beobachters, Versagen des Instruments, etc., Unterbrechungen entstehen.

Deshalb ist es dringend erwünscht, dass Ende Februar 1891 von der Coast and Geodetic Survey gleichzeitig ein Beobachter und ein Instrument nach Honolulu gesandt werden, so dass doppelte Reihen gewonnen werden wie seinerseits hier in Berlin und Potsdam. Natürlich muss das Instrument auch die Genauigkeit einer Breitenbestimmung aus einem Sternpaare an einem Abend von $0''\cdot 1$ bis $0''\cdot 2$ gewähren. Das wird sich ja wohl erreichen lassen.

The observations were treated according to the method adopted by Prof. Albrecht in his reduction of Dr. Marcuse's work as embodied in the "Resultate der Beobachtungsreihen in Honolulu, betreffend die Veränderlichkeit der Polhöhe, Berlin, 1890," with this difference, that the adjustment in the present case involved five conditional equations. This was made necessary from the fact that group II was again observed in 1892, and also that during the year's observations three separate combinations of three groups were made.

DESCRIPTION OF STATION.

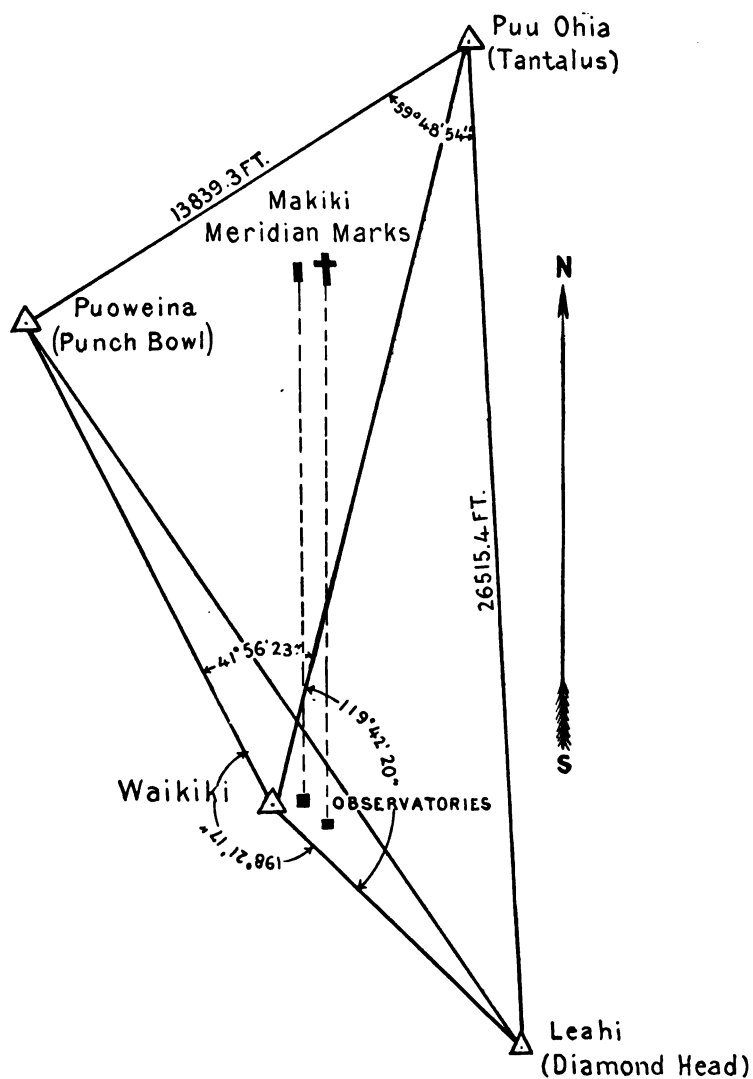
The station of observation was located at Waikiki, 2 miles SE. of Honolulu, on the property of Mr. J. F. Brown, who generously gave the use of the ground for the whole time of occupation. The position of the observatory is shown in illustration No. 10, which also includes the three triangulation points to which the Waikiki triangulation station was referred. The distance from the seashore to the zenith telescope pier is 400 feet. The geodetic difference as given by

Mr. Lyons between the positions of the Government Survey observatory in Honolulu and the U. S. Coast and Geodetic Survey observatory at Waikiki is as follows:

$$\begin{aligned}d\phi &= 9658 \text{ feet} = 1' 35''.5 \\d\lambda &= 9785 \text{ " } = 1' 43''.6 = 6.9\end{aligned}$$

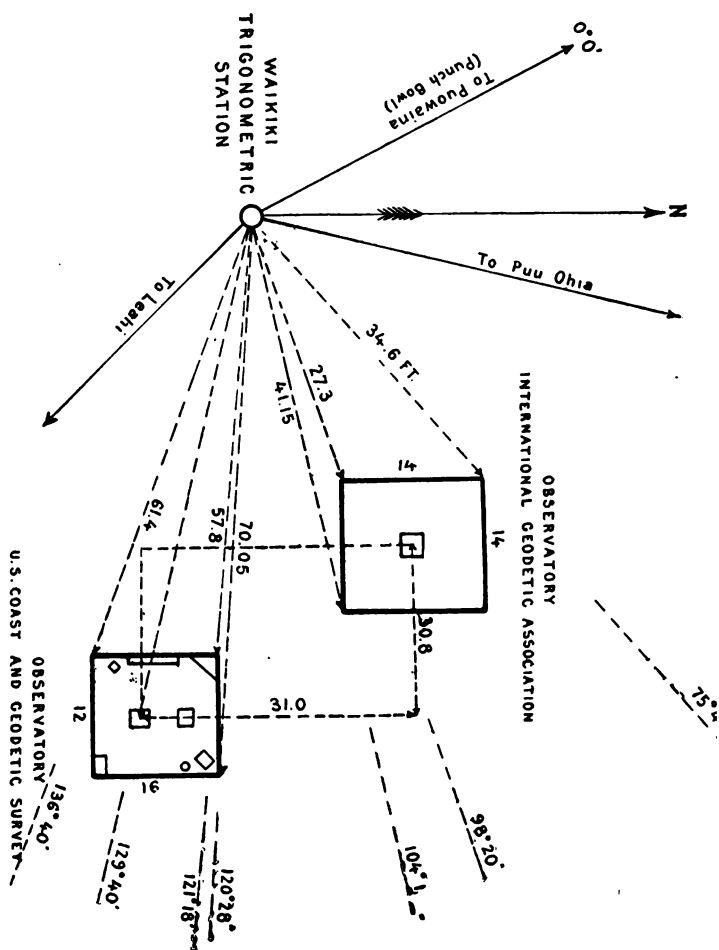
The astronomical latitude of the former (Coast and Geodetic Survey Report, 1888, Appendix 14, p. 495) is $21^{\circ} 18' 2''.48$. This determination was made about April 1. The latitude of Waikiki at this season of the year is not far from $21^{\circ} 16' 24''.70$, so that we have a difference of astronomical latitudes of $1' 37''.8$, which would indicate a deflection of the plumb line between Honolulu and Waikiki of $2''.3$ in latitude. The astronomical amplitude being greater than the geodetic one, would indicate that the plumb line at the northern station (Honolulu) was deflected farther south than the one at Waikiki. This result is not in accordance with what we might expect, since the great mass of the island lies to the northward, and the greater proximity of Waikiki to the seashore would tend to draw its vertical to the southward. The astronomical difference of longitude between the same two stations was determined by Mr. C. J. Lyons, assistant in charge of the Government Survey Office, and myself. The method employed was by exchanging signals over the telephone wire. The chronometers were rated at the two observatories, and the signals were sent in both directions by tapping on the transmitter box. A number of taps were made at different parts of the second-hand dial to eliminate any effect of eccentricity. The Waikiki chronometer had a rate of about 20^s daily, which enabled us to get a coincidence of beats nearly every day of the exchanges, so that there were no fractional parts of a second to be estimated. No high degree of precision was expected in the results, yet they agreed within one-fifth of a second for the six days. Stars were employed at Waikiki in getting the diurnal correction, whereas at Honolulu the sun was used. On one day the exchanges were made to depend entirely on the sun at both places as a test. This day's work agreed well with the others. The azimuth of the Honolulu instrument was not very accurately known; but as the sun only was observed at this place, and as moreover its declination at the time was about $21^{\circ} 30'$, and the latitude of the station was $21^{\circ} 18'$, it is evident that the azimuth was without any effect on the time observations. The mean result from several days' work was $7^s.4$, which gives a difference between the astronomical and geodetic amplitude of $0^s.5$, the astronomical being the greater. The connection of the two stations would seem to indicate a deflection of the plumb line at Honolulu towards the ESE., or in the opposite direction at Waikiki.

The connection of the Waikiki triangulation point with the Government Survey stations is shown in illustration No. 10. This connection was made independently by Mr. J. S. Emerson and myself. The two measures checked each other and the agreement was satisfactory.



CONNECTION OF OBSERVATORIES WITH
OAHU TRIANGULATION.

DETAIL SKETCH—SHOWING POSITIONS OF THE OBSERVATORIES
WITH REFERENCE TO TRIGONOMETRIC STATION.



On the variation of latitude at Waikiki, Hawaiian Islands.

With a 6-inch theodolite, kindly loaned by Prof. Alexander, I measured at Waikiki the three angles defined by Punch Bowl, Tantalus, and Diamond Head, thus closing the horizon and determining the position of Waikiki by the three-point problem.

The result of my own measures gave the following geodetic position for the zenith-telescope pier in the observatory:

$$\begin{array}{r} \text{O} \quad ' \quad '' \\ \varphi = 21 \ 16 \ 26.7 \\ \lambda = 157 \ 50 \ 1.2 \end{array}$$

As the observatories and the piers above ground were removed after the completion of the year's work, it was necessary to connect their positions with the permanent mark at the Waikiki trigonometric station. This was done, and the measurements are given in illustration No. 11.

The observatory was built by Harrison Bros., of Honolulu, and was essentially similar in construction to that built by Dr. Marcuse for the International Association, the Coast and Geodetic Survey building being somewhat different in shape to accommodate a greater number of instruments. Illustration No. 6 gives an exterior view and shows the method of ventilation, the large observing slits, and the means of opening these by a system of pulleys. An interior view appears in illustration No. 7, and shows the disposition of the instruments and indicates the particular class of work to which each one was devoted.

A plan (illustration No. 12) is added, drawn to scale, giving exact dimensions.

INSTRUMENTS.

The entire instrumental outfit taken on the expedition was as follows: Zenith telescope No. 2; meridian telescope No. 2; reconnoitering telescope No. 30; pendulum apparatus B; chronograph, Fauth, No. 6; chronograph, Breguet, No. 5; magnetometer No. 11; dip circle No. 21; mercurial mountain barometer No. 3388; aneroid mountain barometer No. 211; Baudin thermometers 9252, 11316, 11319; sidereal break-circuit chronometer Negus, 1825; mean time break-circuit chronometer, Bond, 177; sidereal watch 1335020; photographic outfit.

The following miscellaneous objects were also taken: Two tents, 8 by 8; wall tent and fly, 10 by 12; tarpaulins; 8 dry-cell batteries; 8 Fuller compound batteries; chronometer cases; electric lamps; switches; oil stove; metre scale; plane-table compass; steel tape, and insulated wire.

THE ZENITH TELESCOPE.

This instrument was used in all the latitude observations at Waikiki. It has a focal length of 112.1 cm., with a clear aperture of 8.2 cm. It is shown in illustration No. 8. A power of 100 was used in the observations.

Although very easy of manipulation it has serious defects, a few of which will be briefly indicated. The instrument was much too light. A moderate wind affected the levels, and frequently it was necessary to reject observations on account of the uncertainty of the level reading. On one or two occasions of strong wind it was necessary to give up work altogether.

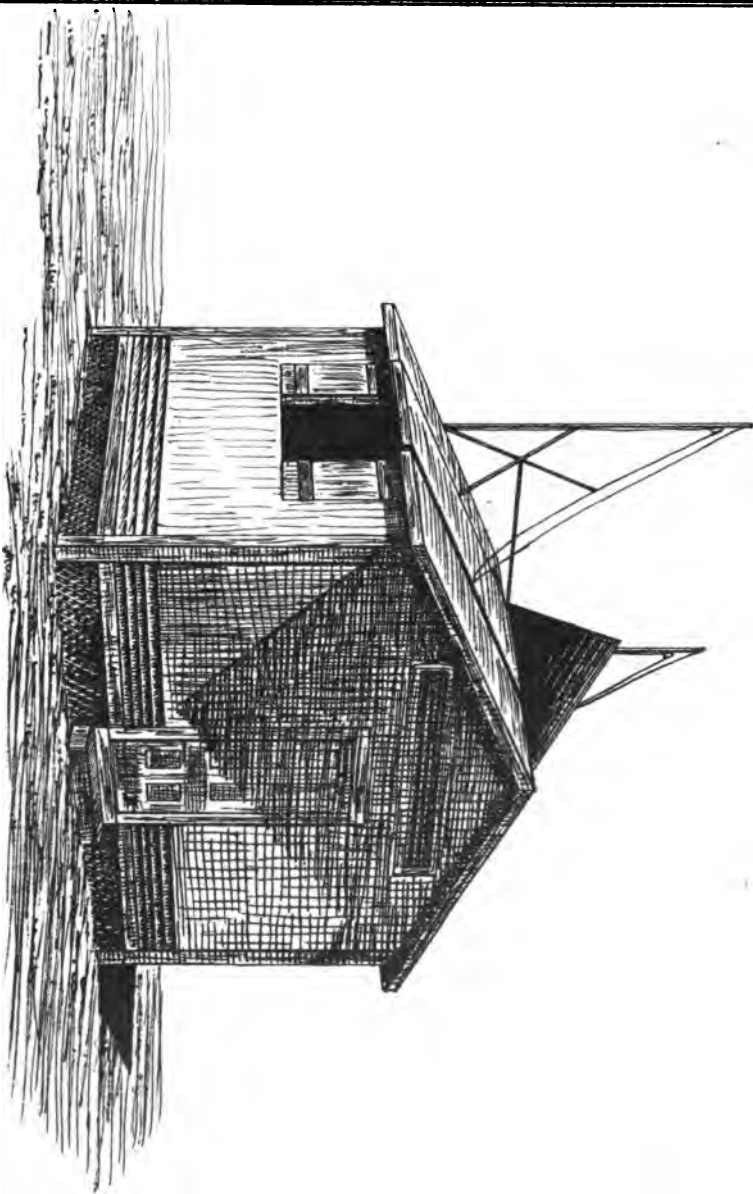
The fact that the time was very limited before leaving Washington will sufficiently explain the haste necessary in the preparation. The zenith telescope was an adaptation of an old form of instrument. The tube is placed centrally, and the remodeling involved the construction of a new projecting platform at the top of the vertical axis. The horizontal axis was made longer than in the old form. The supporting tripod at the base was confessedly much too light, and the double foot-screws, although they gave a fine means of adjustment, possessed very little stability. This defect, combined with the somewhat difficult motion of the micrometer screw, produced considerable discrepancy between the level readings before and after the bisections. This effect was nearly always in the same direction. It varied from $1/10$ of a division to $8/10$ of a division, and indicated that the whole instrument was pushed bodily by the manipulation of the micrometer and revolved about a line passing through the lower part of its base. It is evident that the clamps holding the perforated arm and the fitting of the pivots in the horizontal axis resisted the pressure at the ocular much better than the total weight of the instrument.

No provision was made for reading the micrometer while sitting, because it had been recommended to make only one bisection. When for various reasons it was deemed advisable to point three times on the star, a mirror was attached at an angle of 45° to the line of sight, which enabled the observer to make the readings of the micrometer by reflection without changing position.

By reference to illustrations Nos. 7 and 12, it will be seen that the meridian telescope was mounted north of the zenith telescope. This made it possible to use the former as a collimator for the latter, and as the meridian telescope was kept accurately in the meridian from daily star observations for use in the gravity work, a fine meridian mark was always available inside the observatory. In addition to this a mark was placed on Makiki Ridge 13,000 feet away exactly north of the two piers. This was done by Mr. F. S. Dodge, and its position is shown in illustration No. 9. The deviation in azimuth of the meridian telescope was seldom more than a few tenths of a second of time. The zenith telescope was examined frequently, and was never found out of adjustment beyond the limits prescribed for this kind of work.

The stops on the horizontal circle used in defining the plane of the meridian were only moved when it was necessary to observe circumpolar stars for micrometer value, and only on one or two occasions were latitude and micrometer both observed on the same night. When this

U.S. COAST AND GEODETIC SURVEY OBSERVATORY
WAIKIKI, H.I.





ZENITH TELESCOPE No. 2.



ZENITH TELESCOPE No. 2.

Report for 181



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1938

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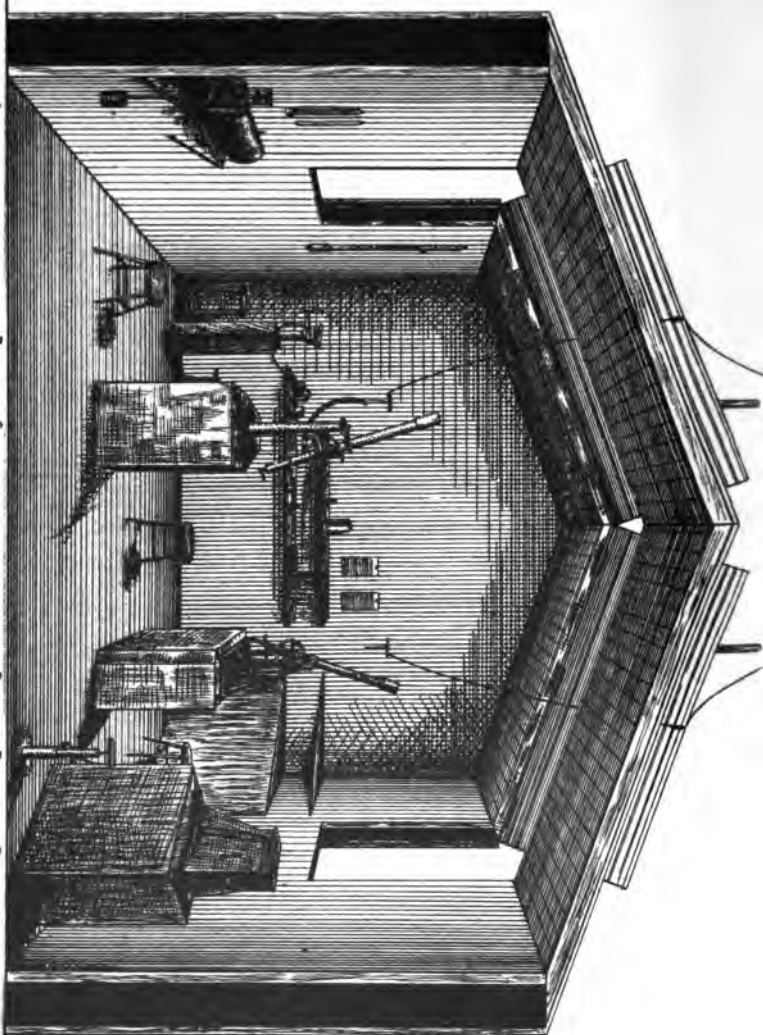
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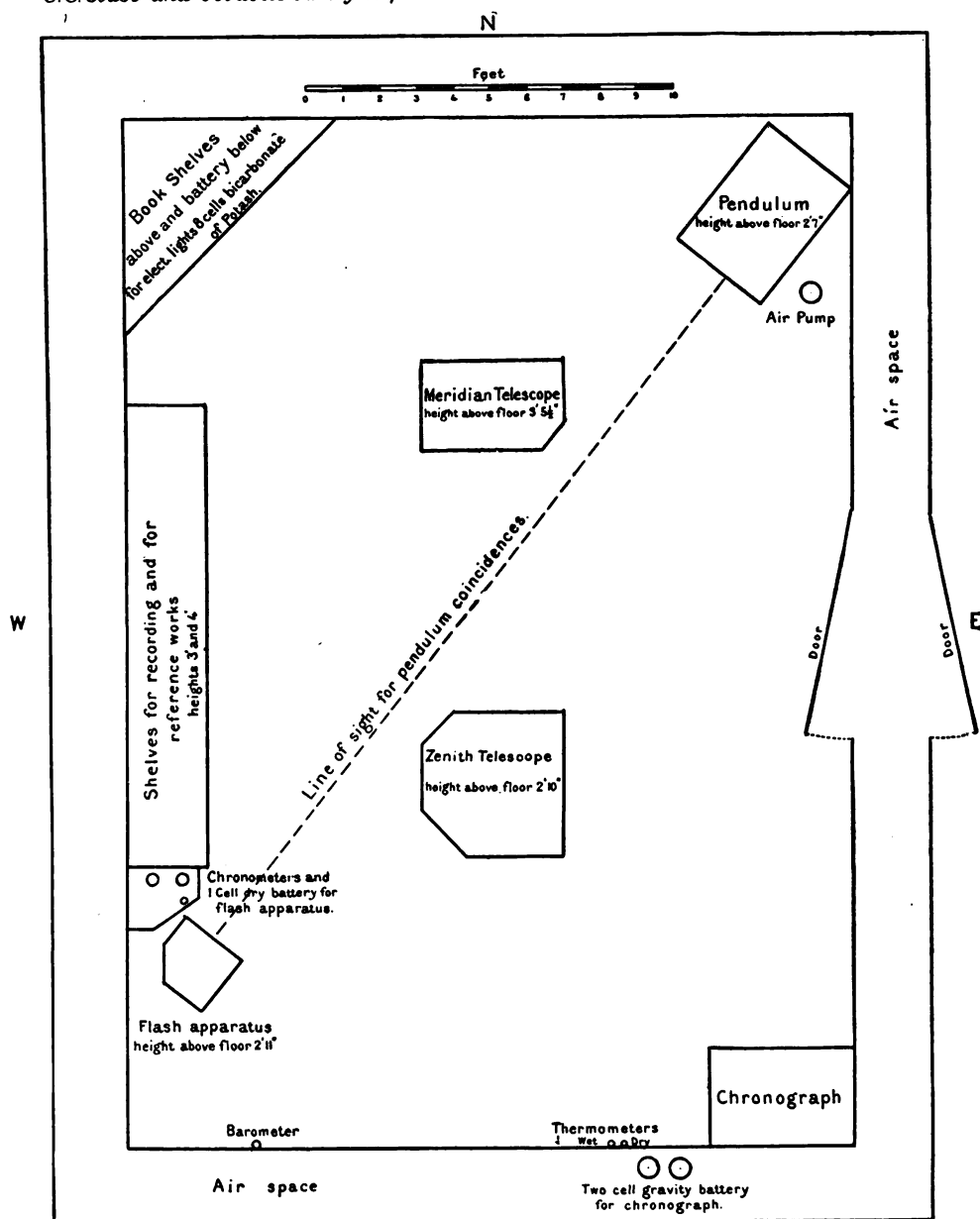
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A - CHRONOGRAPH (TIME)
B - FLASH APPARATUS (GRAVITY)
C - ZENITH TELESCOPE (LATITUDE)

D - MERIDIAN TELESCOPE COMBINATION INSTRUMENT (TIME AND LATITUDE)
E - AIR PUMP FOR VACUUM CHAMBER.
F - PENDULUM RECEIVER (GRAVITY)

Interior View of Observatory





Plan of Observatory

On the variation of latitude at Waikiki, Hawaiian Islands.

was done, the stops were replaced by means of the graduation of the horizontal circle. Indeed the south stop was always so set. The slight deviation of the instrument from the plane of the meridian has very little effect on the resulting value for the latitude if the north and south azimuth are the same, the greatest correction at Waikiki for a zenith distance of 30° being less than $0''.01$ for an azimuth of 10° . When the two azimuths are different the correction is greater; but even in this case if the azimuths do not exceed 10° the correction is hardly worth taking into account. The horizontal circle of the telescope reads to $30''$, and the most violent assumption could never place the instrument out of the meridian more than one minute of arc. Admitting the north azimuth to be practically zero, the correction to the latitude for south stars would still be less than one-hundredth of a second.

The following table gives the correction to the latitude for various zenith distances at Waikiki. The first column is on the supposition that both the N & S azimuths are 10° ; in the second the N one is considered zero and the S one 10° .

Zenith distance.	Corrections to latitude.	
0	//	//
5	0'000	0'001
10	'000	'003
15	'000	'005
20	'002	'008
25	'003	'011
30	'005	'016
	'007	'020

The corrections to the observed latitudes on account of errors of level and collimation were sensibly constant throughout the year and practically insignificant.

The effect of an inclination in the horizontal axis is to make the telescope describe a great circle whose inclination to the plane of the meridian is given by the level readings on the horizontal axis. The star will be observed when it has an hour angle equal to the inclination of the axis in seconds of time multiplied by the level factor B, depending on the star's declination and zenith distance. The effect of an error in collimation is to make the line of light describe a small circle whose distance from the plane of the meridian is measured by the angle between the line of sight and the axis of collimation. The hour angle of an observed star is the distance on the equator in seconds of time multiplied by the secant of the declination. Now the effect on a measured zenith distance will be given in either of these cases by the formula

$$\frac{2 \sin^2 \frac{t}{2}}{\sin 1''} \frac{1}{2} \sin 2 \delta$$

Illustration No. 13 shows the values of the azimuth, level, and collimation factors for Walkiki for every 10° of declination. The greatest value for the level factor for the latitude stars is 1.35, while that of the collimation factor is 1.56. In order to produce a correction to the latitude exceeding $0''.01$ for the highest stars, it would be necessary to suppose a value for the inclination of the horizontal axis of about 1 minute of arc and of several seconds for the error of collimation, neither of which suppositions is admissible. The factors for relative weights, azimuth, level, and collimation in the time reductions were taken from the plotted sheet, and considerably facilitated the reductions.

REDUCTION TO THE MERIDIAN.

In the field reduction of the latitudes the correction for meridian distance was made on the supposition that the star's path from A to B and from B to C in Fig. 1 was a straight line.

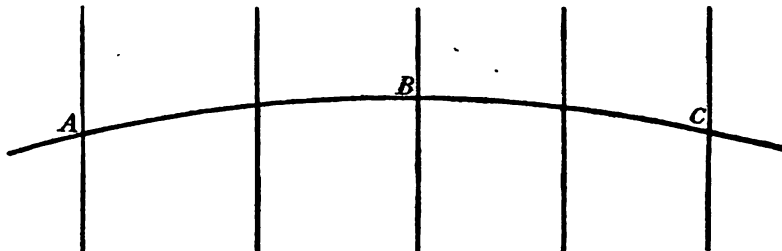
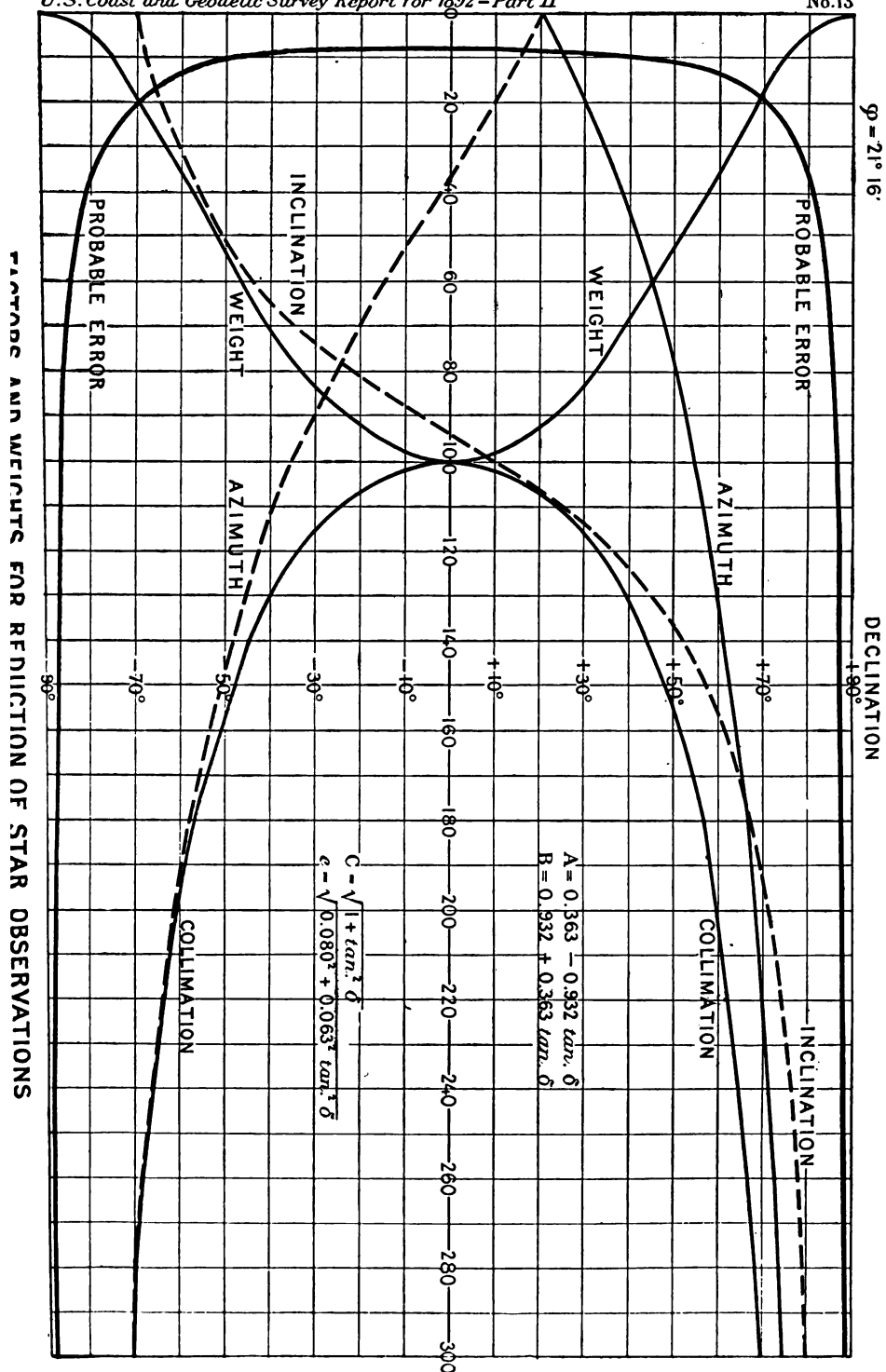


FIG. 1.

The equatorial interval of the vertical threads is $9''.5$. The bisections were made at A, B, and C, or rather the first bisection was never perfected until the star had passed A and the third was finished before it arrived at C, but it is obviously impracticable to designate within several seconds for each particular star just when the pointing was concluded. The error introduced by the above supposition is very much inside that of observation and vastly inferior to the probable error of the declination, and was therefore not considered important in the field reduction. In the final computation, however, a rigorous

correction was applied, and the quantity $\frac{2 \sin^2 \frac{t}{2}}{\sin 1''} \frac{1}{2} \sin 2 \delta$ being represented by m , a correction of $\frac{m}{3}$ was applied to the mean of the three micrometer readings, $\frac{2m}{3}$ being the reduction for a measured zenith distance, and one-half of this being the correction to the latitude.



On the variation of latitude at Waikiki, Hawaiian Islands.

THE MICROMETER.

The value of one revolution of the micrometer screw was determined 12 times with the following results:

Date.	Star.	Intervals.	Elongation.	Value.	Probable error.
1891.				"	"
Aug. 21	Polaris.	Half turns.	East.	46.402	± .013
30	do.	do.	do.	.400	.012
Sept. 17	do.	do.	do.	.348	.018
Nov. 8	δ Ursæ Min.	Whole turns.	West.	.322	.015
8	51 Cephei.	do.	East.	.413	.014
22	δ Ursæ Min.	do.	West.	.342	.015
22	51 Cephei.	do.	East.	.433	.024
1892.					
May 21	δ Ursæ Min.	do.	East.	.452	.017
21	51 Cephei.	do.	West.	.439	.012
June 5	δ Ursæ Min.	do.	East.	.401	.026
10	do.	do.	do.	.391	.025
12	do.	do.	do.	.427	.028

Mean value 46'' 397 ± '' 008

With regard to these determinations it should be remarked that the situation of Waikiki is very unfavorable for such an investigation. The altitude of the stars used was only 21°. This generally would give an unsteady atmosphere, but in addition we had high mountains immediately north of the station, around which the clouds continually hung. The probable error of the determination is therefore large. But when we consider that the zenith distances of the latitude stars are almost perfectly balanced for each group, thus eliminating in the final result any error in the value of the micrometer screw, this slight uncertainty becomes of no importance.

The screw was examined for irregularities in the whole turns in the following manner: The reduced times from 33 turns to 3 turns were tabulated and from them the mean time for one turn was determined. This value being applied to the mean of all the tabulated times, we have the theoretical values corresponding to the different turns, and the difference between these theoretical values and those actually obtained by observation gives the irregularities of the screw at the different turns.

No very decided irregularity was discovered except at the seventh and eighth and thirty-second turns, and even here the correction to the resulting latitudes was too small to be of real importance. Moreover, the number of observations which during the course of the work actually fell on these particular divisions was almost insignificant. No correction was adopted for the periodic inequality, as the observations were scanty and failed to bring out any pronounced fact in regard to it. The range of temperature for the entire year was not more than 11° C., so that the changes of temperature can hardly be said to have influenced the micrometer values.

INCLINATION OF THE MICROMETER THREAD.

For a short time after the beginning of the work the micrometer thread was slightly inclined to the tangent to the star's path at culmination. An adjustment was made on June 20, and its position was not subsequently disturbed. Before this date, all zenith distances which have not corresponding observations before and after the meridian require a very appreciable correction from the above-mentioned cause. After June 20 the adjustment was such that no inclination could be detected by a cursory inspection of the observations. Nevertheless, by combining many of the bisections it was found that the mean inclination gave a value which would still be appreciable when the observation was some distance from the meridian.

Two values for the inclination were therefore deduced—one applicable before and the other after June 20. It is assumed that the inclination did not change between this date and the close of the work more than a year later. This was tested by a careful scrutiny of the record at several epochs during the interval, the greatest difference between the mean value adopted for the inclination and that deduced from individual groups only causing a difference of one or two hundredths of a second in the correction to the latitude.

VALUES OF THE LEVELS.

Zenith telescope No. 2 was provided with two levels made by Reichel. Dr. Marcuse kindly brought these to Washington on his way to Honolulu. They are distinguished as A and B. The values of one division were determined by the maker, by Dr. Marcuse at Berlin and by Mr. Fischer in Washington.

The following were the results:

Values of levels.

Observer.	A.	B.
Reichel	1''·190	1''·276
Marcuse	1''·132	1''·076
Fischer	1''·211	1''·318
Mean	1''·178	1''·223

In December, 1891, a very exhaustive determination was made by myself at Waikiki, using the micrometer attached to the zenith telescope. All parts of the screw were used from 5 turns to 31 turns, and in all about 70 individual values were obtained. When the mean was taken the result was, for A, 1''·194; for B, 1''·230. This was so near the mean of all the others that it was adopted in the latitude computation.

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The level vial as mounted on the telescope is incased in a hollow glass tube, to protect it against sudden changes of temperature. This glass tube is itself covered, except directly above the level scale, by a blanket of thick baize. Attention has sometimes been called to an error of reading from parallax on account of this outer glass tube. An inspection of the formula for the level correction shows the effect of errors from imperfect readings is indeed very small.

If N and S are the readings of the north and south end of the level before reversal, and n and s the readings after reversal, the correction to the latitude, disregarding for the moment the sign, is

$$\frac{(N + S) - (n + s)}{2} \cdot \frac{1}{2}$$

the first factor being the mean motion of the bubble. Now if we suppose one of these readings liable to an error of one-quarter of a division—i. e., supposing the reading was only made to the nearest half division and 1 division = $1''\cdot21$ —the error in the latitude correction is $0''\cdot07$, and when combined with the result from another level the error would only be $0''\cdot03$. Each latitude correction depends on 8 readings (each end of both levels before and after reversal) so that in the mean reading there would necessarily be some compensation of errors, and the effect on the final latitude would certainly not be more than $0''\cdot01$, even if the readings were only made to the nearest half division. Moreover, the above formula shows that if the north end was read too large both before and after reversal the latitude correction is unchanged, and similarly for the south end. This explains to a certain extent the fact that the deduced latitudes are about as concordant where only one reading was made for each star as where the level was read both before and after making the bisections with the micrometer. It is evident that if the influence on the level, consequent upon making the bisections, is in the same direction and of the same amount for both stars the resulting value of the latitude is unchanged.

The large range in the individual values is due principally to the inaccuracies of the level indications. In several cases the original notes remark that the level was moving at the time of reading. These values, however, were retained because the discordant value of the latitude arises in this case from a condition inherent to the instrument, and there is no valid reason for rejecting them.

SPECIMEN OF PROGRAMME OF WORK AND RECORD OF OBSERVATIONS.

The determinations of latitude, time, and gravity during the same evening made it necessary to utilize the intervals between the star pairs, and sometimes between individual stars of the same pair, by observing for time with the meridian telescope and noting the pendulum coincidences with the gravity apparatus.

The following schedule gives a specimen of the programme from 18^h 40^m 10^s, the time of observation of the first star of pair 1 of Group III, to 18^h 55^m 21^s, the time of the first star of pair 2 of the same group:

Time.			Occupation.
<i>h.</i>	<i>m.</i>	<i>s.</i>	
18	40	10	Observe star No. 2633 (Pulkowa).
	40	40	Record bisections, read levels and record.
	42	00	Read inside and outside thermometers and wet and dry bulb.
	44	00	Observe star No. 2647.
	44	50	Start chronograph and switch in chronometer.
	45	50	Observe β Lyræ for time.
	46	10	Set zenith telescope for next pair of latitude stars.
	48	00	Compare chronometers and mark sheet.
	48	45	Point telescope for α Draconis.
	49	15	Observe α Draconis.
	50	00	Set telescope for ϑ Serpentis (pr.).
	50	30	Observe ϑ Serpentis.
	51	00	Stop chronograph, switch out chronograph and start flash apparatus.
18	51	45	Start pendulum.
	52	00	Read manometer and thermometer on dummy and record them.
	54	00	Observe first coincidence and make record.
	55	00	Observe star No. 2681 for latitude.

Specimen of latitude record, 18^h 40^m 10^s to 19^h 3^m 7^s.

Group III.—July 4.

Pair.	Micrometer.				Level A.		Level B.	
	Turns.	Divisions.			N.	S.	N.	S.
1	25	82.5	81.0	81.0	11.9	34.0	62.8	82.6
	13	98.0	2.0	0.0	31.0	9.0	79.9	60.0
2	29	0.0	0.0	99.0	9.0	31.0	60.3	80.0
	11	62.8	62.7	62.5	31.0	9.0	80.0	60.1

From June 6, 1891, to November 15, 1891, the level was only read after the bisections of the star. From November 15, 1891, to June 25, 1892, readings were made before, as well. This course was necessary because no electric lights were provided until November 15, and the great sensitiveness of the levels made it inadvisable to hold the highly heated bull's-eye lantern near enough to read them before the bisection was made.

COMPARISON OF THE LEVELS.

On the whole, level A appeared to be more sensitive than B. They cannot be compared, however, in regard to delicacy by reference to the individual latitude results except in so far as the magnitude of the discrepancies is concerned. If one level is more sensitive than the other,

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whether the resulting latitude is greater or less, depends on the direction of the vertical axis of the instrument. If A has moved farther than B after reversal and the axis of the instrument points to the north of the zenith the latitude from A will be less than from B, whereas in case the instrument points to the south the reverse will be the case. So that the only way is to take actual level readings and compare them. The means for the readings of the two ends of the bubble being taken, and the means for the motion before and after bisections of the star, we have the following table from Group VII. + indicates that A has moved farther than B.

Date.	2	4	5	6	7	8
1892.	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>d</i>
Feb. 24	+0.28	+0.25	+0.02	+0.50	-0.22	0.00
27	+ .05	+ .52	+ .80	+ .07	+ .45	+ .27
28	+ .30	+ .28	+ .35	+ .30	+ .30	— .18
29	+ .32	+ .25	+ .20	+ .65	+ .07	+ .22
March 1	— .15	+ .10	+ .18	+ .42	+ .12	+ .05
2	+ .25	+ .18	+ .55	+ .45	+ .42	+ .10
5	+ .10	— .15	+ .30	+ .17	+ .05	+ .25
9	+ .22	+ .25	+ .22	— .12	— .12	+ .10
10	+ .05	— .05	+ .22	+ .22	— .25	.00
16	+ .10	+ .15	+ .10	+ .07	+ .22	— .18
21	— .48	— .20	— .20	+ .22	+ .10	+ .15
24	+ .25	— .10	— .28	+ .30	+ .02	— .15

The figures are the differences between the motions of the two bubbles, and the table shows that A is in general more sensitive than B.

In order now to see the effect of the discrepancies of the indications of the two levels on the final latitude results, the following summary is given. It is made up from Groups III and VII, involving observations in the warmest part of the year and the coolest. The quantities are the latitude from level A minus that from level B. The mean for the results in August and September is $-0''.062$, and from February and March we get $-0''.022$. The weighted mean is $-0''.045$.

III.	Pair—							
Date.	1.	2.	3.	4.	5.	6.	7.	8.
Star first.	N	N	N	S	N	N	S	N
	$\varphi_A - \varphi_B$	$\varphi_A - \varphi_B$	$\varphi_A - \varphi_B$	$\varphi_A - \varphi_B$	$\varphi_A - \varphi_B$	$\varphi_A - \varphi_B$	$\varphi_A - \varphi_B$	$\varphi_A - \varphi_B$
1891.	"	"	"	"	"	"	"	"
Aug. 5	+·14	+·17	+·11	-·21	+·16	-·13	-·43	-·06
10	-·18	+·28	-·15	-·39	-·09	+·08	-·34	-·14
14	+·09	+·06	-·04	-·21	-·02	-·38	-·28	-·21
15	-·15	-·05	-·49	-·04	+·13	-·16	-·10	+·07
16	-·18	+·07	+·03	-·13	·00	-·05	-·42	+·30
26	-·23	+·35	-·04	-·16	-·20	+·01	-·23	+·27
29	-·05	+·02	+·09	-·18	·00	+·06	-·17	+·10
31	-·40	+·10	+·12	-·21	+·06	-·01	-·43	+·30
Sept. 2	-·33	-·09	+·04	+·05	+·21	+·14	-·13	+·18
9	-·11	+·10	-·06	-·34	-·12	+·13	-·59	-·05
12	-·19	+·23	-·10	-·11	-·16	+·10	-·02	+·24
18	+·06	-·01	+·09	-·14	-·22	-·19	-·04	-·32
	"	"	"	"	"	"	"	"
	-·128	+·102	-·033	-·172	-·021	-·033	-·265	+·057

Mean of results for 8 pairs = -0''·062.

VII.	Pair—						
	Date.	2.	4.	5.	6.	7.	
	Star first.	N $\varphi_A - \varphi_B$	N $\varphi_A - \varphi_B$	S $\varphi_A - \varphi_B$	S $\varphi_A - \varphi_B$	N $\varphi_A - \varphi_B$	
	1892.	"	"	"	"	"	
	Feb. 24	+·11	-·15	·00	-·24	+·14	-·04
	27	·00	-·32	-·39	-·03	+·20	+·11
	28	-·14	-·11	-·12	-·16	+·18	-·12
	29	+·17	-·13	-·20	-·33	-·04	-·13
	Mar. 1	+·19	-·06	-·07	-·21	-·04	+·02
	2	+·14	+·11	-·30	-·22	-·22	-·03
	5	-·04	+·11	-·10	-·05	-·01	-·13
	9	+·12	+·14	-·12	+·08	+·09	-·04
	10	·00	+·04	-·12	-·11	+·15	·00
	16	+·04	+·09	-·03	+·07	-·09	+·08
	21	+·14	+·14	+·03	-·04	-·04	-·06
	24	+·14	+·06	+·22	-·14	-·02	+·10
		+·072	+·010	-·100	-·120	+·025	-·020
							Mean= -''·022

6 pairs give "
8 pairs give -·022
Weighted mean = -·045

The smallness of this quantity is due to the fact that there are about as many positive as negative corrections. If B is always more sluggish than A and to the same degree, and the vertical axis is inclined as often to the north as to the south and by the same amount, it is plain that

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the means of all the latitudes from each level will be equal. We may reasonably suppose that the average difference between A and B as affecting the final latitudes is considerably less than the weighted mean given above.

ATMOSPHERIC PRESSURE AND TEMPERATURE.

The barometer and thermometers were used several times every night in connection with the determinations of the force of gravity. The range during the whole year is so small that these factors can have no influence on the latitude observations as far as changes in the refraction are concerned. The inside temperature of the observatory was about a degree higher than the outside temperature and the range for the whole year during the hours of observation was from 15° C. in January to 26° in August. The barometer ran from 758^{mm} to 768^{mm}.

BATTERIES.

The following batteries were employed in the observatory work. See illustration No. 12.

- I. 5 cells bichromate of potash battery for zenith telescope electric lights. Three cells were used for the hand lamps and one cell for the axis lamp. This battery required renewing every two months.
- II. 2 cells gravity battery (sulphate of copper) for chronographic registration of star transits. The battery required attention twice during the year.
- III. 1 cell Burnley dry battery for gravity flash apparatus. Three of these cells sufficed for the entire occupation of Waikiki involving observations on nearly 200 nights.

RELATIVE PROBABLE ERRORS.

Since different opinions are held among observers as to the relative merits of increasing the number of bisections on a star or increasing the number of levels to be read, or of reading the levels before and after the bisection, it is worth while to examine this point in the light of the observations themselves. The case will also be considered where the levels are read only to the nearest half division.

It would evidently be a waste of labor to work out all the different cases or combinations that could arise under the supposition of one, two, or three bisections, one or two levels, readings made before bisection or after, or readings made with two different degrees of accuracy. This would require 24 cases, being the number of combinations of 4 things, taking 1 out of each of 4 collections, the different collections containing 3, 2, 2, and 2 things, respectively, or, which is the same thing if we consider the bisection and the inclination as the necessary requisites for the result, we have two collections with 3 and 8 things, respectively, which, as before, gives 24 cases. Of these cases the following are worth investigating and are here given with the respective probable errors of observations and that of the mean result. The ob-

servations chosen are those of Group VII, extending over one month, from February 24, 1892, to March 24, 1892, giving 12 values for each pair. Pairs 1 and 3 were not included in the investigation. On account of the short time between the two stars of pair 1, and between pairs 2 and 3 the full complement of level readings could not be made. As one of the objects is to compare results from readings before and after, only pairs were taken giving the necessary data.

Probable errors of observation.

Group VII.	Pair.						Mean.	Probable error from one night's work.
	2.	4.	5.	6.	7.	8.		
	//	//	//	//	//	//	//	//
<i>a</i>	.15	.17	.18	.15	.15	.13	.155	.039
<i>b</i>	.17	.17	.19	.15	.15	.14	.162	.040
<i>c</i>	.23	.25	.26	.17	.14	.21	.210	.052
<i>d</i>	.17	.19	.21	.18	.18	.14	.178	.045
<i>e</i>	.17	.16	.18	.15	.14	.12	.153	.038
<i>f</i>	.17	.16	.22	.16	.17	.12	.167	.042
<i>g</i>	.27	.22	.24	.15	.15	.21	.207	.052

a = 3 bisections, 2 levels, before and after, nearest tenth division.

b = 3 bisections, 2 levels, before and after, nearest half division.

c = 1 bisection, 2 levels, before and after, nearest tenth division.

d = 3 bisections, 2 levels, before, nearest tenth division.

e = 3 bisections, 2 levels, after, nearest tenth division.

f = 3 bisections, 1 level, before and after, nearest tenth division.

g = 1 bisection, 1 level, after, nearest tenth division.

a and *b* have reference to the accuracy necessary in reading the levels.

a and *c* have reference to the number of bisections.

a and *d*, *a* and *e*, have reference to the number of readings to be made of level.

a and *f*, have reference to the number of levels to be read.

d and *e*, have reference to the time of reading level.

g is the case ordinarily employed in the field of work of the C. and G. S.

a is the case employed in the Waikiki work after November 15.

It is not supposed that the conclusions drawn from this investigation apply rigorously to all classes of instruments or to widely different conditions of work, but they certainly form a criterion for judging of the most advantageous way of observing with portable instruments as pursued in the field work of our own service.

THE STAR LIST.

The stars observed for the variation of latitude were identical for the two observers and were selected by Dr. Marcuse before leaving Germany. They were divided into 8 groups, making a total number of 63 pairs. This list was prepared with great care, and combines all the conditions necessary for precise latitude work.

The zenith distances are all within 29°, and the stars are so selected that the sums of the north and south zenith distances for each group

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are practically equal. The declinations of the stars are well determined. Their proper motions are for the most part known, the stars having been observed by Bradley. No bright stars were taken, and those of the same pair were as near as possible of the same magnitude. Moreover, the differences of zenith distances for any pair did not exceed 18', and the difference of right ascension between stars of the same pair was never more than 17 minutes.

The mean places of these stars, as far as concerns the observations made on the part of the Coast and Geodetic Survey, were derived by Mr. Farquhar, of the Computing Division. The same system was followed as in the case of the Rockville observations, and the following extract from Assistant Schott's report on that work is a statement by Mr. Farquhar of the principles on which the reductions were made:

"Combination weights used for adopted polar distances in Rockville latitude list: Twenty catalogues used in computing latitudes on this Survey were tested and their probable errors reported in June, 1890. These results were made the basis of the following series of weights: the unit of weight corresponding to a probable error of $\pm \sqrt{0''\cdot 1}$ and the ratio of observation error to systematic error being taken (for all catalogues alike) $= \sqrt{5}$, so that if w_∞ be the weight of an infinite number of observations and w_1 of one, $w = \frac{n}{n+5} w_\infty = \frac{6n}{n+5} w_1$.

The weight of no polar distance therefore can exceed six times that of a single observation, given in the table below:

Catalogue.

	w_1
Lalande δ , Weisse-Bessel ε	0.015
d'Agelet α , Piazzì β	.02
Rümker ε	.025
Taylor β	.04
Groombridge β	.06
Armagh '75	.07
Armagh '40, Jacob β , Smyth β	.08
Auwers-Bradley α , Paris '45, Main β , Glasgow, Cape '40 ε	.09
Radcliffe '60	.10
Radcliffe '45	.12
Pond β , Cambridge '30 β , Greenwich 6 yr.	.14
Washington	.16
Cape '50 ε , Bonn β , Paris '60, Rome	.18
Paris '75	.20
Henderson, Greenwich 7y1, Melb. β , Cape '80 ε , Ann Arb. ε	.25
Struve Pos. M. β Greenwich 12y (1 + 2), Brussels, Becker ε	.3
Polkowa merid. circle, Greenwich 7y2, Cordoba γ	.35
Abo β , Harv. '85 ε	.4
Greenwich 9y., Harv. '75	.5
Leiden β	.6
Romberg α	.7
Pulkowa vert. circle β , Greenwich 10y.	.8

In this table weights were deduced for catalogues marked:

α from probable errors of observation given in the prefaces to the catalogues.

β from Boss's investigations, $\frac{2}{3}$ of his weights being taken—*i. e.*, his unit being supposed to correspond to a probable error of $\pm \sqrt{0'' \cdot 15}$.

γ from a determination of systematic error by myself, using the method of Boss.

δ from determination of observation error by myself and formula above as in (α).

ϵ from simple estimate, the places being too few for better methods.

Others, from the results obtained in 1890.

Piazzi, Taylor, Jacob, Main, and a few others used by Safford, I have to take at second hand, being without the originals. For stars of the Berliner Jahrbuch, Dr. Auwers's combination of the authorities used by him was usually accepted, $\frac{5}{8}$ of his total weights being allowed them (*i. e.*, his probable error taken $= \pm \sqrt{0'' \cdot 16}$ for $w = 1$) and the weights of this table used for the remaining authorities."

The following is the list with the squares of the probable errors of declination (ϵ^2) and the proper motion in declination (μ):

GROUP I.

Pair.	Right ascension.			Declination.				
	No. Pulkowa.	1892'o.		1892'o.		ϵ^2 .	μ .	
		<i>h.</i>	<i>m.</i>	<i>s.</i>	<i>o</i>	<i>"</i>	<i>"</i>	<i>"</i>
1	2021	13	27	46	— 7	4	3'21	'07 +0'021
	2027		30	2	+49	34	5'82	'02 + '021
2	2056		41	42	26	14	38'75	'03 — '077
	2064		44	16	16	20	1'53	'02 + '029
3	2093	14	3	37	44	22	5'68	'03 — '032
	2113		13	59	— 1	45	57'56	'05 — '079
4	2126		21	26	+19	42	45'63	'03 + '017
	2134		27	40	22	44	8'58	'04 + '030
5	2139		29	59	30	12	51'90	'03 + '119
	2146		36	32	12	7	34'79	'02 — '105
6	2163		46	14	37	42	55'02	'04 + '090
	2177		54	0	4	59	56'95	'05 — '023
7	2204	15	9	58	29	33	55'05	'04 + '019
	2214		17	16	12	57	15'47	'04 — '032

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GROUP II.

Pair.	Right ascension.			Declination.					
	No. Pulkowa.	1892'o.			1892'o.			α.	μ.
		<i>h.</i>	<i>m.</i>	<i>s.</i>	°	"	"	"	"
1	2387	10	37	14	27	7	30.74	.07	—'062
	2409		47	10	15	9	20.51	.04	—'014
2	2420		56	24	22	47	29.61	.05	—'043
	2430		59	59	19	44	54.97	.04	—'016
3	2437	17	4	6	24	37	38.76	.08	—'060
	2456		15	33	18	10	7.51	.06	—'037
4	2464		19	41	16	24	2.32	.05	—'044
	2479		26	22	26	11	32.19	.03	+ '010
5	2501		38	3	24	37	7.43	.03	—'118
	2509		42	22	17	44	14.00	.04	—'017
6	2513		44	26	25	39	32.49	.03	—'049
	2532		55	15	16	45	26.80	.09	—'004
7	2571	18	13	5	13	44	11.14	1.00	—'02
	2580		16	13	28	56	8.76	.14	+ '001
8	2595		22	20	26	23	5.89	.04	—'027
	2621		32	18	16	6	21.20	.04	+ '040

GROUP III.

1	2633	18	40	10	23	28	54.41	.06	—'085
	2647		44	11	19	12	28.93	.06	—'02
2	2681		55	21	26	3	52.78	.06	—'017
	2703	19	3	7	16	41	33.76	.05	—'319
3	2718		7	37	31	6	12.17	.03	—'009
	2743		14	48	11	20	6.62	.18	+ '029
4	2798		33	52	5	9	6.99	.03	—'009
	2822		40	23	37	5	37.24	.02	+ '038
5	2824		42	27	32	37	25.31	.20	—'01
	2832		45	51	10	8	43.83	.05	—'163
6	2862		54	33	22	48	27.34	.02	+ '007
	2886	20	0	22	19	40	54.32	.05	+ '081
7	2893		2	39	9	5	10.33	.06	+ '005
	2925		11	12	33	24	8.09	.08	—'102
8	2936		13	48	37	41	49.86	.06	—'010
	2949		17	50	4	59	53.39	.05	—'036

GROUP IV.

1	3155	21	34	5	1	45	29.83	.09	—'083
	3170		38	46	40	39	41.17	.07	—'000
2	3182		41	45	2	11	11.62	.08	—'022
	3192		45	17	40	38	43.24	.07	—'000
3	2899 Bradley	22	2	0	24	49	3.28	.02	+ '006
	3256		8	0	17	44	46.56	.90	—'075
4	3274		11	16	37	12	39.17	.04	—'005
	3279		15	1	5	14	48.37	.04	—'018
5	3315		30	37	19	43	7.78	.09	—'101
	3010 Bradley		41	20	22	59	50.50	.02	—'016
6	3345		47	10	42	44	17.70	.03	+ '009
	3367		55	6	—0	23	38.49	.03	+ '008
7	3390	23	3	9	+1	32	23.89	.05	+ '108
	3419		13	16	41	11	1.85	.04	—'004
8	3436		17	38	11	43	18.36	.03	—'032
	3463		28	36	30	43	44.90	.02	—'019

GROUP V.

Pair.	Right ascension.			Declination.				
	No. Pulkowa.	1898'o.			1898'o.		e ^a .	μ.
		h.	m.	s.	°	'		
1	88	0	40	12	44	16 15'13	·06	—·014
	111		47	29	— 1	43 51'11	·03	—·020
2	122		51	59	28	24 29'44	·03	—·025
	138		59	23	14	21 53'99	·05	+·033
3	170	1	7	53	24	0 42'00	·05	—·030
	199		20	26	18	36 36'52	·04	+·017
4	211		24	31	5	35 13'03	·03	—·044
	216		28	2	36	40 59'73	·03	—·016
5	235		34	12	40	1 47'52	·03	—·026
	251 Bradley		47	58	2	39 14'74	·03	+·008
6	270		51	27	17	17 23'94	·04	—·032
	296	2	0	42	25	11 20'46	·06	—·031
7	331		12	7	19	24 4'56	·03	—·002
	358		23	4	22	59 11'79	·06	—·018
8	367		27	34	18	24 12'55	·12	+·005
	375		30	47	24	10 36'09	·02	—·019

GROUP VI.

1	598	4	1	7	37	26 36'80	·07	—·180
	606		5	35	5	14 29'71	·07	+·010
2	629		13	4	20	52 49'46	·06	—·050
	662		21	36	21	22 42'17	·06	—·066
3	686		28	24	5	20 29'01	·05	—·062
	725		42	38	37	17 48'94	·03	+·033
4	732		45	3	18	39 19'68	·04	—·046
	751		51	15	23	46 45'41	·10	—·033
5	796	5	7	39	2	43 55'50	·09	—·013
	810		11	33	40	0 8'44	·04	—·667
6	824		15	51	8	19 15'77	·07	+·005
	841		19	40	34	17 45'71	·07	—·015
7	866		25	53	18	30 47'88	·04	—·014
	874		28	51	23	58 1'37	·04	—·031
8	939		47	59	20	15 19'68	·03	—·108
	960		55	10	22	23 50'48	·04	—·024

GROUP VII.

1	1164	7	4	41	27	2 0'15	·04	—·058
	1173		6	39	15	21 32'51	·15	+·015
2	1198		16	53	25	15 26'93	·03	—·029
	1217		25	35	17	18 54'88	·07	—·088
3	1223		28	41	46	25 3'51	·07	—·040
	1232		31	55	—3	52 13'01	·04	+·020
4	1250		40	33	33	40 48'22	·02	—·042
	529 Greenwich 87		51	24	8	55 46'55	·25	—·025
5	1291		55	44	—1	5 35'72	·06	—·078
	1298		59	41	43	34 10'39	·07	—·056
6	1345	8	21	3	—3	37 56'96	·04	—·045
	1376		33	33	46	12 44'13	·04	+·083
7	1410		45	54	32	52 42'29	·05	+·014
	1429		51	53	9	48 12'15	·07	—·000
8	1453	9	2	26	27	4 32'24	·04	—·384
	1464		6	23	15	25 50'97	·05	+·236

On the variation of latitude at Waikiki, Hawaiian Islands.

Pair.	Right ascension.			Declination.				
	No. Pulkowa.	1892'o.			1892'o.		°. '.	μ.
		<i>h.</i>	<i>m.</i>	<i>s.</i>	<i>°</i>	<i>'</i>	<i>''</i>	<i>''</i>
1	1585	10	2	10	10	31	36.16	.03
	1598		8	54	32	00	14.13	.03
2	1624		19	34	9	20	1.16	.04
	1640		25	43	32	56	1.22	.03
3	1656		32	58	38	28	22.62	.05
	1667		37	3	4	8	49.99	.04
4	1713		54	48	39	47	31.41	.05
	1727	11	1	24	2	32	30.35	.03
5	1743		13	15	38	46	40.06	.06
	1754		20	6	3	53	45.71	.09
6	4875 Yarnall		22	23	—1	6	20.37	.11
	1763		24	40	43	45	57.42	.04
7	1739		40	18	7	8	4.47	.04
	1795		44	5	35	31	54.18	.11
8	1802		50	7	16	14	51.97	.04
	1827		6	22	26	28	18.52	.05

METHOD OF FINDING APPARENT POSITIONS OF THE STARS.

The reductions from mean to apparent declination were made by means of the independent star numbers.

In Appendix No. 13, Report for 1888, a differential method is described. Its application reduced the time and labor about one-half as compared with the usual way. But this method was devised to meet those cases where a large number of pairs had been observed on a few consecutive nights. The time of occupation of a station was supposed to be so short that after one date had been computed all others for that particular station could be derived with sufficient accuracy by considering the finite differences of the variables as differentials.

In the present case, however, the problem is entirely different. Here we have one station occupied for more than a year, and each group of stars was continuously observed for three months.

The difference in the two cases is that in the former many stars were observed a few nights, in the latter a few stars were observed on many nights.

It is evident at the outset that whether we use Bessel's star numbers or the independent ones some sort of check computation must be made. Moreover, when observations are made on every clear night and in a locality where more than 200 nights can be obtained in a year, it is probably immaterial whether we compute reductions for necessary dates or whether we simply compute for every other day. It is desirable to have the apparent declination of the stars with no greater error than one or two hundredths of a second for latitude work of the highest precision. A comparison of the changes in the star's position between successive dates, as deduced by the independent numbers and the method here presented of applying Bessel's numbers, shows that in the latter case the errors are absolutely without significance, whereas

the time of reduction is only about one-fourth that required by the usual independent numbers.

The present method was suggested by the following facts:

First, inasmuch as the same star must be reduced for about fifty different dates, a method should be employed in which the quantities depending on the star's position and those depending only on the date of observation are handled separately. This avoids the introduction as a distinct quantity, into each day's computation, of those terms which do not change from day to day. For example, in the use of the independent numbers the logarithms of sine and cosine of the declination are added to the others for every new date computed. Since the star constants do not vary, these are first computed and then applied to the differences of the varying day numbers. Besides, since a number of stars were observed on the same date, we only have to apply the different star constants to the same differences of the day numbers throughout the three months' period.

Of the day numbers it is to be remarked that the principal term of A depends on the sine of the moon's ascending node, and the corresponding one of B depends on the cosine of the same function. The values of A and B can therefore never exceed very much the numerical factors of their principal terms, so that three significant figures need only be considered and they may be dealt with by means of Crelle's tables. C and D vary as the cosine and sine of the sun's longitude, and only change rapidly when they are small in amount, so that their changes also are such that Crelle's tables give all the accuracy necessary. Since the obliquity is practically constant as far as these reductions are concerned, and as the sun's longitude does not change more than a few degrees between the dates chosen, the changes in C and D are either small or quite uniform. It is therefore never necessary to use logarithms to get all the accuracy desirable for the reductions to apparent place.

The star constants having been calculated for the star to be reduced, the values of dA and dB are taken from the Ephemeris, and dC and dB are calculated by using the formulæ

$$dC = 18.7 \, d \cos \odot$$

$$dB = 20.4 \, d \sin \odot$$

the values for dA , dB , dC , and D being tabulated, the star constants a , b , c , and d are applied and the sum of the products gives the reduction from one date to another.

The following table gives the reductions from June 6 to June 28 for star I, α ,* $\alpha = 13^h 27^m 46^s$, $\delta = -7^\circ 4'$, and a comparison of differences for the two methods. To compute the places by the independent star numbers for one group for three months, required generally about eight days, and a check computation using the same method would take as long. By the method of applying differences for a check we get at the same result in about two days.

*Group I, Pair 1, Star α .

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Date.	a. dA	b. dB	c. dC	d. dD	Σ	Ind. Nos.	Δ
June 6	"	"	"	"	"	"	"
	—0.195	—0.002	+0.234	—0.017	+0.020	+0.022	—0.002
8	— .162	— .025	+ .237	— .015	+ .035	+ .032	+ 3
10	— .102	— .029	+ .238	— .012	+ .095	+ .097	— 2
12	— .061	— .011	+ .239	— .010	+ .157	+ .157	0
14	— .073	+ .013	+ .239	— .007	+ .172	+ .174	— 2
16	— .125	+ .026	+ .240	— .004	+ .137	+ .139	— 2
18	— .186	+ .014	+ .240	— .002	+ .066	+ .062	+ 4
20	— .203	— .012	+ .239	— .001	+ .023	+ .013	+ 10
22	— .175	— .033	+ .240	+ .003	+ .035	+ .041	— 6
24	— .117	— .034	+ .239	+ .006	+ .094	+ .095	— 1
26	— .080	— .014	+ .239	+ .008	+ .153	+ .153	0
28							Σ +0.002

The sum of the residuals shows that the apparent places for this whole month could have been obtained by simply adding the differences. The accumulation of error for the entire period is much less than 0".01, so that this short method is quite accurate enough to check the results.

In the computations I had the help of the following persons attached to the Computing Division of the Survey: Mr. H. Farquhar furnished the mean north polar distances for all the stars. Mr. A. L. Baldwin computed the apparent places. Mr. H. L. Stidham checked these, and assisted in the final reductions; and Mr. H. F. Flynn applied the micrometer and level corrections and deduced the latitudes. The final adjustment by least squares, the reductions to the mean declination systems and the derivation of the daily means was participated in by both Mr. Flynn and Mr. Stidham. At the beginning of the work Subassistant John Nelson assisted for a short time. I desire to express my obligations to all these gentlemen, as well as to Assistant C. A. Schott, in charge of the Computing Division, who did everything in his power to facilitate the work.

Illustration No. 14 shows the time of beginning and ending the observations of each group and the period during which any two or three successive groups were observed at the same evening. This diagram is inserted in order to avoid the necessity of publishing the individual results in this particular form on a large sheet for the sake of showing the group connections.

In order to condense as much as possible the publication of the latitudes now under discussion, the following scheme is adopted. First, a specimen record will be given which is copied from the book of observation. Second, a computation of one latitude showing the details and giving the exact form followed throughout the office work, and finally a general table containing all that part of the reduction necessary for a rediscussion should such a step ever be thought advisable, either from improved values in the star places or in the instrumental constants.

The correction for inclination of the micrometer thread is applied in the refraction column.

Specimen of record.

GROUP VII, PAIR 7.

Date.	Micrometer reading.				Level A.				Level B.				Remarks.
	Turns.		Divisions.		Before.		After.		Before.		After.		
1892. Feb. 20	23 13	83°0 27'4	82°2 27'5	82°0 28'3	<i>d.</i> 9.9	<i>d.</i> 34'5	<i>d.</i> 10°2	<i>d.</i> 34'9	<i>d.</i> 59°3	<i>d.</i> 82°8	<i>d.</i> 60°0	<i>d.</i> 83°2	Distinct and steady.

Specimen of computation.

GROUP VII, PAIR 7.

Date.	Pos.	Micrometer.		Level.			Mer.	Declination.
		Reading.	Diff. Z. D.	N.	S.	Diff.	Dist.	
1892. Feb. 20		<i>t.</i> <i>d.</i>	<i>t.</i> <i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>s.</i>	° ' "
	N	23 82·4		44·4	44·9	+0·5	15	32 52 45·46
	S	13 27·7	—10 54·7	45·1	46·0	0·9	13	9 48 11·83
				142·1	143·3	1·2		
				143·2	143·9	0·7		

Sum and half sum.	Corrections.				Latitude.	Mean.
	Micrometer.	Level.	Ref.	Mer.		
° ' "	' "	"	"	"	"	
42 40 57·29		+0·15			24·16	21° 16'
21 20 28·64	— 4 04·67	·27	—0·07	+0·04	·25	24'' 20
		·37		+ ·01		
		·22				

GROUP I, PAIR 1.

The latitude value may differ in some cases from that which would apparently result from the corrections given. This comes from neglected decimals. In the computations four values were derived corresponding to the level readings before and after bisection and to



Results from observations for the variation of latitude at Waikiki, Hawaiian Islands.

different levels and the adopted latitude is a mean between the two readings of the same level and then between the two levels. The level correction given is a mean one which would give a latitude differing very slightly in a few cases from that obtained in the usual way. This difference is entirely without significance.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N.	S.		Mic.	Level.	Ref.	Mer.	
1891.	t. d.	t. d.	° ' "	' "	" "	" "	" "	° ' "
June 7	21°07.9	18°27.2	21 15 20.23	+1 5.12	—0.41	—0.33	+0.06	21 16 24.67
8	21°84.1	19°05.8	20.30	4.56	—1.08	+0.02	+0.04	23.84
9	22°96.0	20°21.1	20.38	3.77	+0.63	+0.02	+0.04	24.84
11	21°95.3	19°15.3	20.54	5.00	—1.46	+0.02	+0.04	24.14
13	21°94.5	19°34.0	20.77	0.43	+3.56	+0.02	+0.04	24.82
15	21°18.9	18°32.8	21.02	6.37	—2.81	—0.13	+0.04	24.50
16	21°15.7	18°44.0	21.15	3.05	+0.32	+0.02	+0.04	24.58
17	21°40.7	17°67.5	21.26	3.37	+0.05	+0.02	+0.05	24.75
18	21°52.7	18°70.7	21.36	5.42	—2.77	+0.02	+0.09	24.12
22	22°52.3	19°74.6	21.56	4.42	—1.20	—0.04	+0.07	24.81
26	21°11.7	18°34.5	21.78	4.30	—1.93	+0.02	+0.09	24.26

GROUP I, PAIR 2.

1891.	t. d.	t. d.	° ' "	' "	" "	" "	" "	° ' "
June 6	22°12.9	18°96.2	21 17 38.66	—1 13.47	—0.06	—0.32	+0.04	21 16 24.85
7	22°29.3	19°04.1	38.76	15.42	+1.15	—0.02	+0.03	24.50
8	22°27.4	19°04.2	38.85	14.98	+0.30	—0.02	+0.03	24.18
10	21°83.1	18°55.0	39.06	16.11	+1.92	—0.02	+0.03	24.88
11	21°74.2	18°46.7	39.18	15.98	+0.37	—0.02	+0.03	23.58
12	21°09.2	17°85.2	39.30	15.16	+0.01	—0.02	+0.03	24.16
13	21°73.0	18°47.7	39.45	15.46	+0.56	—0.02	+0.03	24.56
15	21°92.6	18°64.0	39.76	16.23	+0.85	—0.20	+0.03	24.21
16	22°23.1	18°91.2	39.92	17.00	+2.20	—0.02	+0.03	25.13
17	21°82.5	18°48.0	40.05	17.60	+1.80	—0.02	+0.05	24.28
18	21°88.9	18°54.4	40.18	17.60	+1.97	—0.02	+0.05	24.58
19	21°32.9	17°98.3	40.28	17.62	+1.71	—0.02	+0.05	24.40
22	21°46.2	18°09.3	40.50	18.16	+1.91	—0.02	+0.05	24.28
24	21°76.5	18°40.4	40.64	17.97	+1.96	—0.02	+0.05	24.66
26	21°16.0	17°84.6	40.81	16.88	+0.16	—0.02	+0.05	24.12
27	21°33.8	18°02.4	40.92	16.88	+0.39	—0.02	+0.05	24.48
28	21°98.3	18°58.2	41.04	18.90	+2.09	—0.02	+0.05	24.26
30	20°75.6	17°33.9	41.27	19.27	+2.17	—0.02	+0.05	24.20

GROUP I, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891. June 6	20°34'3	19°06'7	21 15 46.30	+0 37.68	+0.33	+01	+03	21 16 24.35
7	20°40'7	20°06'8	46.45	36.21	+1.76	+01	+03	24.46
8	20°04'4	21°68'7	46.60	38.12	— .34	+01	+03	24.42
9	20°40'8	22°01'4	46.74	37.26	+ .79	+19	+03	25.01
10	19°38'8	20°03'1	46.88	35.80	+ .79	+01	+03	23.51
11	19°75'5	21°38'4	47.03	37.79	— .48	+01	+03	24.38
12	20°38'4	22°00'8	47.18	37.68	— .71	+01	+03	24.19
13	19°83'4	20°39'0	47.38	36.10	+ .90	+01	+03	24.42
15	20°68'7	21°26'6	47.76	36.63	— .19	+01	+03	24.24
17	19°07'8	20°57'1	48.15	34.64	+1.37	+01	+06	24.23
18	18°25'7	19°80'0	48.34	35.80	+ .39	+01	+06	24.60
19	19°12'0	20°60'2	48.49	34.38	+ .82	+01	+06	23.76
22	19°02'7	21°32'2	48.88	32.36	+2.71	+01	+06	24.02
24	19°17'7	20°60'2	49.10	33.06	+2.18	+01	+06	24.41
26	18°70'1	20°13'8	49.36	33.34	+1.39	+01	+06	24.16
27	17°06'8	19°43'0	49.52	33.92	+ .85	+01	+06	24.36
28	19°00'0	21°38'5	49.67	32.59	+2.03	+01	+06	24.36
30	19°23'1	20°67'5	50.00	33.50	+ .56	+01	+04	24.11

GROUP II, PAIR 1.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891. June 10	10°21'8	30°74'1	21 08 28.22	+7 56.10	+ .51	—01	+03	21 16 24.85
11	10°13'5	30°69'5	28.40	56.96	— .82	—01	+03	24.56
13	9°87'3	30°36'2	28.79	55.31	+ .12	+14	+03	24.39
15	9°84'5	30°30'0	29.25	54.52	+ .67	—21	+03	24.26
17	10°40'6	30°81'3	29.74	53.41	+1.39	+14	+05	24.73
18	10°32'2	30°76'7	29.96	54.29	+0.41	+14	+05	24.85
19	10°28'4	30°72'1	30.20	54.11	+0.14	+14	+05	24.64
22	10°14'8	30°66'8	30.73	56.03	—2.58	+14	+05	24.37
24	9°02'9	29°35'5	31.04	51.53	+1.88	+14	+03	24.62
26	9°40'0	29°72'5	31.38	51.51	+1.18	+14	+05	24.26
27	9°26'4	29°62'4	31.58	52.32	+ .43	+14	+05	24.52
28	9°68'0	29°03'8	31.77	49.96	+2.78	+14	+05	24.70
30	8°46'5	28°85'1	32.20	52.92	— .23	+14	+05	25.08
July 4	8°09'0	29°36'0	33.01	52.55	—1.79	+14	+05	23.96
7	9°11'8	29°46'7	33.42	52.07	—1.05	+16	+04	24.64
8	9°24'7	29°57'0	33.58	51.46	— .97	+14	+05	24.26
17	10°58'0	30°69'1	35.14	46.54	+1.94	+14	+05	23.81
18	8°89'5	29°16'9	35.28	50.33	—1.35	+06	+16	24.48
22	9°09'8	29°21'8	35.70	49.07	— .65	+14	+06	24.32
23	9°06'0	29°22'0	35.82	47.68	+1.06	+14	+05	24.75
25	8°49'2	28°65'2	36.07	47.68	+0.08	+06	+07	23.96
26	9°38'3	29°52'8	36.22	47.33	+1.34	+14	+05	25.08
27	9°88'3	29°08'5	36.38	48.66	— .64	+14	+05	24.59
29	8°01'2	29°09'1	36.71	45.80	+ .97	+18	+04	23.70
Aug. 2	8°80'7	28°01'9	37.12	46.57	+ .52	+14	+05	24.40
3	8°59'0	28°73'6	37.18	47.36	— .06	+14	+05	24.67
4	9°13'9	29°25'8	37.25	46.73	— .51	+14	+05	23.66
5	8°05'2	29°02'4	37.32	45.64	+1.57	+14	+05	24.72
6	8°00'4	28°03'6	37.40	44.71	+1.99	+16	+06	24.32
10	9°54'2	29°65'3	37.83	46.54	0.00	+14	+05	24.56
12	8°88'4	28°04'0	38.06	45.27	+0.47	+14	+05	23.99
13	9°67'3	29°70'1	38.14	44.62	+1.34	+14	+05	24.29
14	8°31'9	28°47'4	38.22	47.57	—1.42	+14	+05	24.56
15	9°61'4	29°67'1	38.26	45.29	+ .41	+14	+05	24.15
16	9°57'7	29°61'2	38.30	44.78	+1.29	+14	+05	24.56

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP II, PAIR 2.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. "	Ref. "	Mer. "	
1891.								
June 10	20°48'0	20°89'0	21 16 13'12	+0 09'51	+1'11	+1'15	+0'03	21 16 23'92
11	21°00'7	21°50'0	13'30	11'44	-0'63	+0'00	+0'03	24 14
13	19°77'4	20°21'0	13'70	10'11	+0'46	+0'00	+0'03	24 30
17	20°47'0	20°83'5	14'66	08'47	+2'11	-47	+0'04	24 81
18	20°53'2	21°93'4	14'91	09'32	+0'32	00	+0'05	24 60
19	18°85'9	19°18'5	15'16	07'56	+1'44	00	+0'05	24 21
24	19°76'6	20°04'3	16'06	06'43	+1'65	00	+0'05	24 19
26	18°85'0	19°14'6	16'40	06'87	+1'40	00	+0'06	24 73
27	20°55'3	20°85'6	16'60	06'89	+0'48	00	+0'05	24 02
28	18°93'9	19°14'8	16'81	04'85	+2'27	00	+0'05	23 98
30	19°46'2	19°73'2	17'26	06'26	+0'32	00	+0'07	23 91
July 4	20°56'7	20°89'0	18'11	07'49	-1'75	00	+0'05	23 90
7	19°66'1	19°95'5	18'59	06'82	-0'78	00	+0'05	24 68
8	19°73'3	19°90'5	18'73	03'99	+1'08	00	+0'05	23 85
17	19°86'5	20°03'8	20'40	04'01	-0'32	00	+0'05	24 14
18	19°60'8	19°73'9	20'54	03'04	-0'22	-0'08	+0'06	23 34
22	19°64'7	19°81'7	21'02	03'94	-0'85	00	+0'05	24 16
23	18°62'9	18°68'4	21'14	01'28	+1'59	00	+0'05	24 06
24	18°92'2	19°00'0	21'26	01'81	+ 57	00	+0'06	23 70
25	19°03'7	19°08'0	21'42	01'00	+ 91	00	+0'03	23 36
26	19°25'2	19°27'3	21'57	00'49	+1'85	00	+0'05	23 96
27	19°78'7	19°86'3	21'74	01'76	+ 32	00	+0'05	23 87
29	19°66'6	19°75'8	22'08	02'13	- 67	00	+0'05	23 59
31	19°39'3	19°48'5	22'36	02'13	- 88	-0'02	+0'05	23 64
Aug. 2	19°27'6	19°29'1	22'56	00'35	+ 98	00	+0'05	23 94
3	19°45'0	19°50'8	22'64	01'35	- 34	00	+0'05	23 70
4	19°35'3	19°36'0	22'72	+0 00'16	+1'23	-0'03	+0'07	24 15
5	19°34'3	19°37'6	22'80	+0 00'77	+ 03	00	+0'05	23 65
6	19°21'5	19°17'0	22'88	-0 01'04	+2'45	00	+0'05	24 34
7	18°61'4	18°59'3	22'99	-0 00'49	+1'19	00	+0'05	23 74
10	19°55'0	19°58'9	23'36	+0 00'90	- 43	00	+0'05	23 88
13	19°40'1	19°30'7	23'72	-0 02'18	+2'07	00	+0'05	23 66
14	18°99'9	18°99'0	23'79	-0 00 21	+0'05	00	+0'05	23 68
15	19°26'7	19°38'4	23'87	+0 02'71	-2'85	00	+0'05	23 78
16	19°50'0	19°47'2	23'92	-0 00'65	- 02	00	+0'05	23 30

GROUP II, PAIR 3.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. "	Ref. "	Mer. "	
1891.			° ' "	' "	"	"	"	° ' "
June 13	29°19'2	9°86'1	21 23 53'32	-7 28'45	+ '95	- '13	+ '03	21 16 25'72
17	29°64'2	10°22'2	54'32	30'52	+1'16	- '13	+ '03	24'86
18	29°75'9	10°38'3	54'56	29'49	- '07	- '13	+ '03	24'90
22	28°71'0	9°26'5	55'39	31'10	+ '96	- '17	+ '02	25'10
24	29°14'2	9°63'7	55'74	32'49	+1'97	- '17	+ '02	25'07
26	28°03'1	8°54'2	56°09	32'12	+ '88	- '13	+ '03	24'75
27	28°10'6	8°64'8	56°30	31'40	- '08	- '13	+ '03	24'72
28	28°20'6	8°71'2	56°50	32'23	+ '08	- '17	+ '02	24'20
30	28°05'0	8°55'1	56°97	32'35	+ '09	- '17	+ '02	24'58
July 4	28°35'3	8°90'4	23 57'85	31'19	-2'00	- '13	+ '03	24'56
17	28°11'8	9°50'5	24 00'21	34'99	- '46	- '14	+ '04	24'66
18	27°62'8	8°01'7	00'36	34'95	- '61	- '17	+ '02	24'65
22	28°71'5	9°12'4	00'87	34'48	-1'36	- '16	+ '05	24'92
23	28°88'0	9°14'3	01'00	37'87	+1'55	- '13	+ '03	24'58
26	28°84'0	8°35'7	01'44	37'64	+ '90	- '13	+ '03	24'60
27	28°38'2	8°76'8	01'63	35'02	-1'23	- '13	+ '05	25'30
29	28°25'6	8°58'9	01'08	36'24	-1'45	- '17	+ '02	24'14
Aug. 2	28°89'4	9°10'0	02'50	39'19	+ '88	- '17	+ '02	24'04
3	28°09'6	8°40'3	02'58	36'85	- '65	- '13	+ '03	24'98
4	28°81'2	9°08'3	02'66	37'68	- '45	- '15	+ '02	24'40
5	28°37'1	8°61'0	02'76	38'42	+ '10	- '13	+ '03	24'34
6	27°82'0	8°01'8	02'84	39'38	+1'24	- '13	+ '03	24'60
7	27°75'8	8°08'9	02'95	36'59	-1'67	- '13	+ '03	24'89
10	28°91'5	9°16'6	03'34	38'15	- '57	- '13	+ '03	24'52
11	29°83'5	9°01'9	03'98	39'70	+ '48	- '13	+ '01	24'64
13	28°47'5	8°59'8	03'72	41'12	+1'70	- '13	+ '03	24'20
14	28°85'8	9°06'2	03'82	39'24	-0'02	- '13	+ '05	24'48
16	28°46'7	8°63'7	03'95	40'03	+ '24	- '13	+ '03	24'06

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP II, PAIR 4.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.								
June 10	21°11'4	17°62'2	21 17 45.34	-1 21.01	00	---03	+03	21 19 24.33
11	20°03'2	16°58'2	45.54	20.04	-1.79	---18	+03	23.56
13	20°29'1	16°76'6	45.94	21.78	00	---03	+03	24.16
17	21°91'4	18°34'4	46.92	22.82	+ .04	---03	+05	24.16
18	20°55'9	17°02'9	47.18	21.89	-1.15	---03	+05	24.16
19	20°53'5	16°89'6	47.44	24.42	+1.26	---03	+05	24.30
22	19°84'3	16°20'1	48.04	24.49	+ .17	---03	+05	23.74
26	19°64'3	15°98'1	48.77	24.95	+ .03	---03	+05	23.87
27	19°84'0	16°21'9	48.98	24.00	- .66	---03	+05	24.34
28	20°54'9	16°92'0	49.18	24.19	- .97	---03	+05	24.04
30	20°00'7	16°32'5	49.66	25.42	- .51	---01	+04	23.76
July 4	20°93'6	17°29'9	50.58	24.37	-2.41	---03	+05	23.82
7	19°55'6	15°84'0	51.09	26.20	- .70	+00	+06	24.25
8	20°34'4	16°49'7	51.24	29.24	+1.66	---03	+05	23.68
17	20°64'2	16°83'9	53.02	28.22	-1.10	---03	+05	23.72
18	19°34'7	15°51'8	53.18	28.83	-1.20	---03	+06	23.18
22	20°25'8	16°47'9	53.72	27.67	-2.15	---03	+05	23.92
23	19°93'6	16°03'7	53.86	30.45	+ .67	---03	+05	24.10
24	19°86'0	16°01'3	54.00	29.24	-1.20	---03	+07	23.60
26	20°38'3	16°44'2	54.33	31.42	+ .83	---03	+05	23.76
27	19°73'7	15°87'9	54.51	29.50	-1.37	---03	+05	23.66
29	20°65'3	16°76'1	54.88	30.29	- .87	---03	+05	23.74
31	20°32'5	16°47'9	55.20	29.22	-2.46	---03	+05	23.54
Aug. 2	20°35'8	16°41'6	55.44	31.45	- .01	---03	+05	24.00
4	20°74'3	16°82'3	55.63	30.94	- .99	---03	+05	23.72
5	20°62'8	16°69'5	55.72	31.24	- .73	---03	+05	23.77
6	20°47'5	16°47'2	55.82	32.86	+ .24	---03	+05	23.22
7	20°33'9	16°45'5	55.93	30.10	-2.65	+01	+04	23.23
10	20°20'1	16°28'1	56.35	30.94	-1.47	---03	+05	23.96
11	20°16'6	16°17'9	56.50	32.49	- .12	---03	+05	23.91
13	20°55'3	16°50'2	56.76	33.98	+ .58	---03	+05	23.38
14	20°44'0	16°30'0	56.88	36.04	+2.44	---03	+05	23.30
15	20°48'5	16°43'4	56.95	33.98	+0.79	---03	+05	23.78
16	20°35'7	16°28'3	57.02	34.51	+1.29	---03	+05	23.82

GROUP II, PAIR 5.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. l. d.	S. l. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "					° ' "
June 11	12°26'5	27°24'1	21 10 37'17	+5 47'42	- '61	+ '10	+ '03	21 16 24'11
13	12°74'3	27°65'8	37'59	46'01	+ '52	+ '10	+ '03	24'25
17	13°93'8	28°77'4	38'58	44'17	+ '64	- '37	+ '04	24'06
18	13°69'2	28°56'8	38'84	45'10	+ '33	+ '10	+ '05	24'42
22	12°79'0	27°59'3	39'74	43'41	+ '23	+ '10	+ '05	24'53
24	11°59'2	26°31'2	40'12	41'48	+ '219	+ '12	+ '05	23'96
26	12°93'8	27°71'8	40'50	42'87	+ '28	+ '10	+ '05	24'80
27	13°47'2	28°25'9	40'72	43'04	+ '32	+ '14	+ '04	24'26
28	12°81'5	27°61'3	40'93	43'29	+ '12	+ '10	+ '05	24'49
30	11°51'3	26°27'2	41'42	42'39	+ '36	+ '10	+ '05	24'32
July 4	12°51'1	27°32'9	42'36	43'76	- '56	+ '10	+ '05	24'71
8	12°80'4	27°48'7	43'06	40'62	+ '11	+ '10	+ '05	23'94
17	12°01'7	26°63'2	44'90	39'05	- '38	+ '07	+ '05	23'69
18	12°19'1	26°81'8	45'10	39'32	- '47	+ '09	+ '05	24'09
26	12°51'1	26°55'1	46'30	36'38	+ '30	+ '09	+ '05	24'12
27	11°84'9	26°47'0	46'50	37'56	- '30	+ '09	+ '05	23'90
29	11°69'4	26°23'1	46'84	37'24	- '33	+ '07	+ '04	23'86
Aug. 2	12°31'6	26°78'5	47'50	35'66	+ '92	+ '09	+ '05	24'22
3	12°03'3	26°55'2	47'60	36'82	- '16	+ '09	+ '05	23'40
4	12°54'0	27°05'9	47'71	36'82	- '27	+ '11	+ '05	24'42
5	11°77'9	26°26'1	47'82	35'96	+ '18	+ '09	+ '05	24'10
6	12°03'3	27°05'3	47'92	34'52	+ '10	+ '09	+ '05	23'68
7	11°74'5	26°30'9	48'04	37'86	- '96	+ '09	+ '05	24'08
10	12°79'0	27°28'8	48'48	36'33	- '05	+ '09	+ '05	23'90
13	12°46'9	26°81'1	48'93	32'71	+ '200	+ '09	+ '05	23'78
14	11°66'7	26°39'9	49'06	34'80	- '34	+ '09	+ '05	23'66
15	12°41'0	26°76'3	49'15	32'97	+ '48	+ '09	+ '05	23'74
16	11°72'4	26°13'1	49'23	34'22	+ '29	+ '09	+ '05	23'88

GROUP II, PAIR 6.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. l. d.	S. l. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "					° ' "
June 13	14°82'8	25°12'4	21 12 25'48	+3 58'85	+ '68	- '11	+ '02	21 16 24'92
17	15°03'0	25°26'2	26'50	57'37	+ '23	- '41	+ '07	24'76
18	14°18'8	24°46'6	26'76	58'44	- '20	+ '07	+ '05	25'12
19	13°51'8	23°73'3	27'02	56'97	+ '55	- '18	+ '04	25'40
22	14°03'1	24°20'7	27'66	56'07	+ '32	+ '03	+ '04	25'12
26	14°87'7	25°02'2	28'43	55'35	+ '24	+ '07	+ '05	25'14
27	14°00'6	24°17'7	28'66	55'95	+ '23	+ '07	+ '05	24'96
28	14°87'1	25°06'5	28'88	56'49	- '24	+ '07	+ '05	25'25
30	13°82'9	23°97'0	29'36	55'26	+ '55	+ '05	+ '04	25'26
July 4	14°22'2	24°41'5	30'33	56'47	- '08	+ '07	+ '05	24'84
8	14°43'6	24°49'7	31'06	53'40	+ '47	+ '07	+ '05	25'05
18	14°53'2	24°48'3	33'12	50'85	+ '32	+ '07	+ '05	24'41
26	13°38'6	23°25'2	34'38	48'88	+ '26	+ '07	+ '05	24'64
27	13°17'0	23°12'7	34'58	50'99	- '59	+ '07	+ '05	25'10
29	13°37'6	23°31'2	34'98	50'50	- '68	+ '10	+ '08	24'98
31	13°42'1	23°36'0	35'34	50'57	- '50	+ '03	+ '04	24'48
Aug. 3	14°26'4	24°17'6	35'74	49'94	- '61	+ '07	+ '05	25'19
4	13°53'2	23°42'4	35'84	49'48	- '76	+ '10	+ '06	24'72
5	13°92'5	23°82'0	35'94	49'55	- '44	+ '03	+ '04	25'12
6	13°55'2	23°29'2	36'06	45'95	+ '212	+ '03	+ '04	24'20
7	14°67'5	24°60'6	36'18	50'38	- '29	+ '07	+ '05	24'39
10	12°76'3	22°63'0	36'64	48'90	- '99	+ '07	+ '05	24'67
13	13°44'6	23°16'4	37'10	45'44	+ '224	+ '07	+ '05	24'90
14	13°46'2	23°27'2	37'24	47'58	- '31	- '05	+ '12	24'58
15	13°28'9	23°05'0	37'34	46'44	+ '70	+ '08	+ '08	24'64
16	13°73'3	23°51'8	37'43	47'00	+ '32	+ '07	+ '05	24'87

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP II, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "					° ' "
June 10	24°37'6	15°99'5	21 20 02.46	-3 37.62	- .73	- .06	+ .03	21 16 24.08
13	24°72'7	15°33'1	03.08	37.97	- .46	- .06	+ .03	24.62
18	24°86'2	15°43'5	04.40	38.69	- .69	- .31	+ .05	24.76
19	24°04'1	15°49'7	04.66	41.41	+ 1.07	- .06	+ .06	24.32
22	25°17'7	15°65'7	05.33	40.85	- .09	- .06	+ .06	24.39
26	24°53'7	14°97'0	06.13	41.94	+ .41	- .06	+ .06	24.60
27	25°05'3	15°53'1	06.36	40.90	- .70	- .06	+ .06	24.76
28	24°00'0	14°39'5	06.58	42.82	+ .06	- .06	+ .06	23.82
30	25°11'0	15°55'8	07.08	41.59	- .95	- .06	+ .06	24.54
July 4	23°37'3	13°87'5	08.10	41.04	- 2.87	- .03	+ .06	24.22
8	24°45'5	14°82'0	08.82	43.52	- .67	- .10	+ .05	24.58
18	24°19'1	14°47'8	11.05	45.33	- 1.31	- .06	+ .07	24.42
22	24°64'3	14°91'6	11.71	45.65	- 1.96	- .06	+ .04	24.08
23	24°64'4	14°79'9	11.87	48.39	+ .34	- .12	+ .04	23.74
24	24°10'8	14°28'3	12.03	47.92	- .09	- .06	+ .07	24.03
26	24°41'8	14°56'1	12.41	48.67	+ .64	- .06	+ .06	24.38
27	24°26'2	14°47'9	12.62	46.95	- 1.39	- .06	+ .06	24.28
29	24°64'3	14°85'5	13.05	47.07	- 1.38	- .06	+ .06	24.60
30	23°60'5	13°76'4	13.26	48.30	- .72	- .06	+ .06	24.24
Aug. 2	23°44'6	13°56'7	13.76	49.18	- .41	- .10	+ .05	24.12
3	24°35'1	14°53'1	13.89	47.81	- 1.70	- .06	+ .06	24.38
4	23°59'3	13°74'4	14.02	48.48	- 1.59	- .06	+ .06	23.95
5	24°14'3	14°31'0	14.14	48.11	- 1.99	- .06	+ .06	24.04
6	24°02'7	14°08'3	14.26	50.69	+ 1.08	- .06	+ .06	24.65
7	24°66'7	14°73'5	14.39	50.41	+ .09	- .06	+ .06	24.07
10	23°33'3	13°46'6	14.88	48.90	- 1.94	- .06	+ .06	24.04
13	23°66'3	13°63'0	15.40	52.75	+ 1.25	- .06	+ .06	23.90
14	24°60'4	14°67'0	15.56	50.46	- 1.03	- .06	+ .06	24.07
15	24°20'4	14°26'9	15.68	50.48	- 1.26	- .06	+ .06	23.94
16	23°52'0	13°54'8	15.78	51.34	- .40	- .06	+ .06	24.04

GROUP II, PAIR 8.

Date.	t. d.		° ' "	' "	" "	" "	" "	° ' "
	t. d.	t. d.						
1891.								
June 10	18°12'3	22°78'8	21 14 34.76	+ 1 48.22	+ 0.23	+ .03	+ .03	21 16 23.27
17	17°38'2	21°93'7	36.42	45.67	+ 1.55	+ .51	+ .07	24.22
18	17°43'7	22°06'9	36.70	47.46	- .22	+ .03	+ .05	24.02
19	17°83'5	22°39'2	36.98	45.72	+ 1.83	- .45	+ .16	24.24
22	18°55'5	22°13'2	37.64	46.18	+ .30	+ .03	+ .05	24.20
26	17°70'6	22°22'0	38.50	44.72	+ 1.05	+ .03	+ .05	24.35
27	18°00'4	22°53'2	38.72	45.04	- .01	+ .03	+ .05	23.83
28	16°58'6	21°03'0	38.96	43.09	+ 1.17	+ .03	+ .08	23.33
30	17°23'2	21°72'5	39.46	44.23	+ .36	+ .03	+ .05	24.13
July 8	17°22'7	21°64'7	41.30	42.54	- .02	+ .03	+ .05	23.90
18	16°55'3	20°89'7	43.54	40.77	- .59	+ .03	+ .05	23.80
22	16°84'5	21°16'8	44.23	40.29	- .58	+ .06	+ .13	24.13
24	16°63'1	20°89'9	44.56	39.01	+ .39	+ .03	+ .05	24.04
26	17°11'5	21°28'1	44.95	36.64	+ 1.55	+ .03	+ .05	23.22
29	15°74'9	20°01'6	45.61	38.99	- .98	+ .03	+ .05	23.70
30	18°35'8	21°58'7	45.82	38.11	- .26	+ .07	+ .04	23.78
Aug. 2	17°02'6	21°21'6	46.36	37.20	+ .76	- .00	+ .08	24.40
3	16°83'1	21°05'6	46.50	38.01	- 1.06	+ .03	+ .05	23.53
5	16°74'4	20°95'4	46.70	37.67	- .93	+ .03	+ .05	23.52
6	16°60'6	20°68'6	46.89	34.65	+ 2.24	+ .03	+ .05	23.86
7	16°70'7	20°78'4	47.02	34.58	+ 1.74	+ .03	+ .05	23.42
10	16°63'0	20°82'8	47.54	37.39	- 1.32	+ .03	+ .05	23.69
13	16°65'0	20°75'6	48.08	35.25	+ .67	+ .03	+ .05	24.08
14	17°24'6	21°37'6	48.24	35.81	- .19	+ .03	+ .05	23.94
15	17°04'6	21°16'8	48.36	35.62	- .38	+ .03	+ .05	23.68
16	17°17'6	21°24'7	48.49	34.44	+ .38	+ .03	+ .05	23.39

GROUP III, PAIR 1.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "					° ' "
July 4	25° 81' 5	14° 00' 0	21 20 37.18	-4 10.89	-1.73	-07	+05	21 16 24.54
8	24° 72' 2	13° 80' 4	38.02	13.28	-1.12	-07	+05	24.60
17	24° 78' 9	13° 80' 0	40.10	14.93	-0.65	-07	+05	24.50
18	24° 36' 2	13° 35' 5	40.32	15.34	-0.32	-07	+05	24.64
23	25° 22' 1	13° 08' 6	41.22	18.32	+1.78	-05	+05	24.68
24	24° 90' 5	13° 82' 2	41.40	17.11	+0.50	-07	+05	24.77
26	24° 22' 9	13° 05' 0	41.80	19.34	+1.94	-07	+05	24.38
27	24° 87' 7	13° 79' 4	42.02	17.11	-0.65	-07	+05	24.24
29	24° 48' 8	13° 39' 0	42.49	17.46	-0.91	-07	+05	24.10
30	24° 32' 0	13° 18' 4	42.71	18.36	0.00	-07	+05	24.33
Aug. 3	24° 48' 3	13° 31' 0	43.44	19.20	-0.15	-07	+05	24.07
5	24° 15' 1	13° 00' 3	43.70	18.62	-0.52	-07	+05	24.54
6	24° 83' 5	13° 57' 6	43.85	21.19	+1.88	-07	+05	24.52
7	24° 76' 6	13° 48' 4	43.99	21.72	+1.87	-07	+05	24.12
10	24° 67' 5	13° 49' 9	44.53	19.27	-0.70	-07	+05	24.54
13	24° 53' 4	13° 22' 9	45.10	22.26	+1.02	-07	+05	23.84
14	25° 12' 8	13° 88' 4	45.26	20.84	-0.04	-07	+05	24.36
15	24° 66' 2	13° 41' 0	45.42	21.03	-0.30	+01	+08	24.18
16	24° 74' 2	13° 48' 5	45.54	21.14	0.00	-07	+05	24.38
22	24° 54' 8	13° 15' 1	46.21	24.39	+2.44	-07	+05	24.24
23	24° 90' 4	13° 58' 6	46.36	22.56	+0.64	-07	+05	24.42
25	25° 12' 6	13° 81' 0	46.68	22.51	+0.62	-07	+05	24.77
26	24° 96' 5	13° 51' 3	46.83	25.67	+3.62	-07	+05	24.70
29	24° 87' 9	13° 50' 0	47.19	23.98	+0.87	-07	+05	24.06
Sept. 2	25° 98' 7	14° 49' 3	47.44	26.64	+4.12	-07	+05	24.90
9	25° 61' 1	14° 25' 3	48.11	23.49	-0.30	-07	+05	24.30
12	24° 94' 1	14° 57' 8	48.32	23.60	-0.30	-07	+05	24.40
18	25° 11' 4	13° 69' 1	48.44	25.00	+1.17	-07	+05	24.59
19	25° 50' 6	14° 11' 1	48.50	24.35	+0.57	-07	+05	24.70
26	25° 16' 0	13° 76' 8	48.80	24.28	+0.38	-07	+05	24.88
28	24° 85' 4	13° 44' 0	48.74	24.79	+0.58	-07	+05	24.51

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP III, PAIR 2.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "	' "	" "	" "	" "	° ' "
July 4	28°9'7	11°62'7	21 23 07.24	-6 42.96	- '01	- '12	+ '05	21 16 24.20
8	29°49'6	12°07'5	08.10	44.14	+ '20	- '12	+ '05	24.09
17	29°64'3	12°14'3	10.22	45.97	- '18	- '12	+ '05	24.00
18	28°81'6	12°34'9	10.45	45.21	- '88	- '12	+ '05	24.29
22	28°27'5	10°79'0	11.22	45.63	- '34	- '12	+ '05	24.18
23	28°51'6	10°90'5	11.40	48.55	+ '97	- '10	+ '05	24.77
26	28°47'9	10°90'1	11.99	47.78	- '34	- '12	+ '05	23.80
27	30°11'6	12°54'0	12.22	47.74	- '41	- '20	+ '13	24.00
29	29°13'0	11°52'6	12.70	48.39	- '46	- '12	+ '05	23.78
30	29°16'8	11°55'2	12.92	48.66	- '15	- '12	+ '05	24.04
31	29°18'1	11°60'0	13.16	48.85	- '90	- '12	+ '05	24.34
Aug. 2	28°60'6	10°97'6	13.54	48.99	- '28	- '12	+ '05	24.20
3	29°68'2	12°05'4	13.70	48.94	- '82	- '15	+ '06	23.85
5	28°85'3	11°19'4	13.99	49.66	- '50	- '12	+ '05	23.76
6	29°50'9	11°82'4	14.14	50.27	+ '42	- '12	+ '05	24.22
7	29°38'7	11°62'7	14.28	52.00	+ '97	- '12	+ '05	24.18
10	29°25'6	11°63'3	14.84	48.83	- '208	- '12	+ '05	23.86
13	29°61'1	11°85'1	15.44	52.00	+ '51	- '12	+ '05	23.88
14	29°75'7	11°99'6	15.61	52.03	- '12	- '12	+ '05	23.39
15	28°85'8	11°12'8	15.78	51.31	- '58	- '12	+ '05	23.82
16	29°82'9	12°05'5	15.92	52.33	+ '72	- '12	+ '05	24.24
20	28°88'7	11°06'4	16.38	53.47	+ '29	- '12	+ '05	24.13
22	29°34'4	11°53'1	16.64	53.24	+ '55	- '12	+ '05	23.88
23	28°89'8	11°07'8	16.80	53.40	+ '57	- '12	+ '05	23.90
25	29°43'9	11°62'2	17.14	53.33	+ '84	- '12	+ '05	24.58
26	29°23'1	11°32'2	17.29	55.46	+ '246	- '12	+ '05	24.22
29	29°73'9	11°93'4	17.70	53.05	- '31	- '12	+ '05	24.27
31	29°29'9	11°48'9	17.86	53.16	- '38	- '12	+ '05	24.25
Sept. 2	29°33'8	11°55'1	17.98	52.63	- '12	- '12	+ '05	24.16
6	29°96'3	12°08'3	18.36	54.79	+ '92	- '12	+ '05	24.42
9	28°71'8	10°95'8	18.72	52.00	- '214	- '12	+ '05	24.51
15	29°17'7	11°21'1	19.07	56.78	+ '94	- '12	+ '05	24.16
18	29°23'7	11°29'2	19.17	56.30	+ '50	- '12	+ '05	24.30
19	29°87'6	11°99'6	19.22	54.79	- '22	- '12	+ '05	24.14
26	29°75'7	11°82'5	19.62	56.00	+ '35	- '12	+ '05	23.90
27	29°28'1	11°28'2	19.60	57.55	+ '72	- '12	+ '03	23.68
28	28°17'3	10°25'9	19.59	55.58	+ '24	- '12	+ '05	24.18

GROUP III, PAIR 3.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "			
1891.			° ' "					° ' "		
July 4	14° 66' 8	23° 40' 1	21 13 02' 18	+3 22' 59	— 26	+ 06	+ 04	21 16 24' 62		
8	14° 53' 2	23° 21' 8	03' 04	21' 50	+ 12	+ 06	+ 05	24' 76		
17	15° 05' 1	23° 67' 2	05' 16	19' 99	— 1' 62	+ 06	+ 05	23' 64		
18	14° 13' 4	22° 73' 0	05' 40	19' 41	— 32	+ 06	+ 05	24' 60		
22	14° 63' 4	23° 24' 3	06' 19	19' 72	— 1' 68	+ 06	+ 05	24' 34		
23	14° 93' 0	23° 43' 8	06' 37	17' 37	+ 1' 20	+ 09	+ 06	25' 09		
26	14° 79' 0	23° 30' 7	06' 98	17' 58	+ 24	+ 10	+ 04	24' 94		
27	15° 06' 7	23° 60' 7	07' 20	18' 12	— 1' 35	+ 06	+ 05	24' 08		
29	14° 89' 2	23° 38' 0	07' 68	16' 91	— 45	+ 10	+ 04	24' 28		
30	14° 20' 7	22° 69' 3	07' 91	16' 86	— 42	+ 06	+ 05	24' 46		
31	15° 34' 1	23° 84' 9	08' 14	17' 37	— 1' 40	+ 08	+ 05	24' 24		
Aug. 2	14° 23' 8	22° 70' 9	08' 54	16' 51	— 64	+ 06	+ 05	24' 52		
3	15° 49' 5	23° 99' 0	08' 70	17' 07	— 1' 06	+ 09	+ 06	24' 86		
5	15° 04' 3	23° 50' 2	09' 00	16' 24	— 63	+ 06	+ 05	24' 72		
6	15° 18' 7	23° 61' 4	09' 16	15' 49	— 54	+ 06	+ 05	24' 22		
7	15° 55' 8	23° 92' 1	09' 30	14' 01	+ 98	+ 06	+ 05	24' 40		
10	15° 00' 9	23° 46' 4	09' 86	16' 14	— 1' 87	+ 06	+ 05	24' 24		
13	14° 87' 9	23° 20' 6	10' 48	13' 17	+ 36	+ 06	+ 05	24' 12		
14	15° 25' 0	23° 62' 3	10' 65	14' 24	— 97	+ 06	+ 05	24' 03		
15	15° 29' 7	23° 72' 0	10' 83	15' 40	— 1' 72	+ 06	+ 05	24' 62		
16	15° 54' 3	23° 88' 5	10' 98	13' 52	— 13	+ 06	+ 05	24' 48		
20	15° 55' 1	23° 85' 6	11' 46	12' 66	+ 27	+ 06	+ 05	24' 50		
22	14° 81' 6	23° 13' 6	11' 73	13' 01	— 31	+ 06	+ 05	24' 54		
23	14° 51' 2	23° 82' 1	11' 89	12' 76	— 34	+ 06	+ 05	24' 42		
26	15° 36' 9	23° 57' 3	12' 40	10' 32	+ 1' 40	+ 06	+ 05	24' 23		
29	15° 53' 5	23° 82' 3	12' 82	12' 27	— 98	+ 06	+ 05	24' 22		
31	15° 56' 5	23° 86' 2	13' 00	12' 48	— 93	+ 06	+ 05	24' 66		
Sept. 2	14° 76' 1	23° 03' 5	13' 14	11' 94	— 1' 40	+ 03	+ 05	23' 76		
6	15° 29' 8	23° 55' 1	13' 53	11' 46	— 1' 02	+ 05	+ 05	24' 07		
9	14° 86' 8	23° 15' 1	13' 91	12' 15	— 1' 91	+ 05	+ 05	24' 25		
12	15° 41' 9	23° 66' 7	14' 18	11' 34	— 1' 65	+ 05	+ 05	23' 97		
15	15° 17' 3	23° 33' 7	14' 31	09' 39	+ 14	+ 05	+ 05	23' 94		
18	14° 98' 6	23° 15' 1	14' 43	09' 42	— 05	+ 05	+ 05	23' 90		
19	14° 62' 7	22° 82' 6	14' 50	10' 20	— 45	+ 01	+ 04	24' 30		
26	14° 80' 7	22° 92' 3	14' 94	08' 28	+ 53	+ 05	+ 05	23' 85		
27	14° 84' 2	22° 98' 9	14' 94	09' 00	+ 52	+ 05	+ 05	24' 56		
28	14° 97' 4	23° 09' 1	14' 93	08' 30	+ 79	+ 05	+ 05	24' 12		

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP III, PAIR 4.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "			
1891.										
July 4	8:47:0	31:29:2	21 07 12:46	+9 12:63	— .76	+ .19	+ .05	21 16	24:57	
8	7:00:3	30:83:3	13:34	12:82	— 1:12	+ .17	+ .06		25:26	
17	7:67:8	31:42:3	15:47	10:85	— 2:19	+ .17	+ .06		24:36	
18	8:41:6	31:12:4	15:72	09:99	— .96	+ .17	+ .06		24:98	
23	6:65:8	30:26:9	16:71	07:74	+ .17	+ .12	+ .09		24:83	
26	6:93:9	30:53:1	17:32	07:30	— .49	+ .17	+ .06		24:36	
27	6:73:5	30:36:6	17:56	08:27	— 1:58	+ .17	+ .06		24:48	
29	6:40:0	29:99:0	18:06	07:25	— 1:46	+ .23	+ .05		24:13	
30	7:73:1	31:32:6	18:30	07:37	— 1:39	+ .16	+ .06		24:50	
Aug. 2	7:81:2	31:37:7	18:95	06:67	— 1:23	+ .12	+ .04		24:55	
3	6:62:6	30:22:2	19:12	07:39	— 1:81	+ .10	+ .04		24:84	
5	6:97:7	30:53:9	19:44	06:60	— 1:96	+ .16	+ .06		24:30	
7	6:37:3	29:84:5	19:76	04:51	+ .20	+ .16	+ .06		24:69	
10	6:53:7	30:07:2	20:33	05:98	— 1:99	+ .16	+ .06		24:54	
13	7:07:3	30:50:1	20:97	03:50	— .21	+ .16	+ .06		24:48	
14	5:74:2	29:17:9	21:16	03:70	— 1:16	+ .16	+ .06		23:92	
15	6:36:2	29:89:0	21:35	05:82	— 2:64	+ .16	+ .06		24:75	
16	7:02:6	30:44:6	21:52	03:31	— .71	+ .16	+ .06		24:34	
20	6:03:9	29:41:5	22:04	02:29	— .24	+ .16	+ .06		24:31	
22	6:66:5	30:10:0	22:33	03:66	— 1:51	+ .16	+ .06		24:70	
23	7:11:2	30:50:4	22:50	02:66	— .68	+ .16	+ .06		24:70	
25	6:84:5	30:17:3	22:86	01:18	— .12	+ .16	+ .06		24:14	
26	6:14:4	30:44:1	23:05	00:46	+ .41	+ .16	+ .06		24:14	
29	7:10:0	30:44:7	23:52	01:62	— 1:83	+ .16	+ .06		23:53	
31	7:07:5	30:43:5	23:74	01:92	— 2:08	+ .16	+ .06		23:80	
Sept. 2	7:07:1	30:38:7	23:90	00:90	— .84	+ .16	+ .06		24:18	
6	7:05:9	30:40:6	24:34	01:62	— 2:04	+ .16	+ .06		24:14	
9	7:09:4	30:46:2	24:76	02:10	— 2:76	+ .16	+ .06		24:32	
12	7:07:9	30:40:8	25:09	01:20	— 2:33	+ .16	+ .06		24:18	
15	7:42:6	30:65:8	25:26	+8 58:95	— .17	+ .16	+ .06		24:26	
18	7:30:3	30:52:1	25:44	58:62	— .44	+ .16	+ .06		23:84	
19	6:75:5	30:00:4	25:52	59:34	— 1:36	+ .16	+ .06		23:72	
26	6:98:8	30:18:6	26:10	58:16	— .65	+ .16	+ .06		23:83	
27	7:50:4	30:68:9	26:12	57:86	— .48	+ .16	+ .06		23:72	
28	5:96:5	29:19:5	26:13	58:90	— .83	+ .16	+ .06		24:42	

GROUP III, PAIR 5.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.								
July 4	29°07	11°87.7	21 22 54.44	-6 30.43	- .79	- .11	+ .05	21 16 23.16
8	27°11.5	10°83.8	55.36	31.52	- .32	- .11	+ .05	23.46
17	27°25.5	10°30.3	57.56	33.26	- .76	- .11	+ .05	23.48
18	28°09.6	11°12.5	57.80	33.70	- .66	- .11	+ .05	23.38
22	27°53.0	10°55.0	58.64	33.91	- 1.27	- .11	+ .05	23.40
23	27°45.5	10°16.5	58.84	36.46	+ 1.30	- .22	+ .08	23.54
26	27°98.2	10°88.6	59.47	36.60	+ .53	- .11	+ .05	23.34
27	27°98.9	10°95.5	59.71	35.16	- .75	- .11	+ .05	23.74
Aug. 2	27°89.4	10°79.8	23 01.14	36.60	- .57	- .15	+ .04	23.86
5	27°94.5	10°79.3	01.66	37.90	- .38	- .11	+ .05	23.32
7	27°64.8	10°41.9	01.98	39.69	+ 1.36	- .15	+ .04	23.54
10	27°52.8	10°39.8	02.58	37.39	- 1.27	- .11	+ .04	23.86
13	27°62.2	10°34.7	03.25	40.75	+ .83	- .11	+ .05	23.28
14	27°26.2	10°04.3	03.52	39.46	- .50	- .11	+ .05	23.50
15	27°82.7	10°64.3	03.67	38.64	- 1.35	- .11	+ .05	23.62
16	27°84.4	10°24.9	03.82	40.15	+ .18	- .11	+ .05	23.79
20	28°59.7	11°29.7	04.36	41.33	+ .55	- .11	+ .05	23.52
22	27°00.3	10°63.4	04.68	40.62	- .48	- .11	+ .05	23.52
23	28°03.5	10°73.4	04.84	41.36	+ .23	- .11	+ .05	23.65
25	28°56.8	11°23.6	05.22	42.08	+ .67	- .11	+ .05	23.75
26	28°91.7	11°58.1	05.42	42.17	+ .52	- .11	+ .05	23.71
29	28°23.7	11°01.3	05.90	39.57	- 2.00	- .11	+ .05	24.27
31	28°42.0	11°12.6	06.14	41.20	- 1.05	- .11	+ .05	23.83
Sept. 2	29°14.7	11°71.1	06.32	44.49	+ 2.19	- .11	+ .05	23.96
6	28°02.8	10°75.5	06.76	40.71	- 1.74	- .15	+ .04	24.20
9	27°54.9	10°27.4	07.20	40.75	- 2.00	- .11	+ .05	24.39
12	28°27.6	10°89.9	07.56	43.12	- .76	- .11	+ .05	23.62
15	28°39.0	11°95.8	07.75	44.40	+ .19	- .13	+ .03	23.44
18	28°81.2	11°38.6	07.94	44.26	+ .26	- .11	+ .05	23.88
19	27°71.5	10°29.3	08.02	44.16	- .12	- .11	+ .05	23.68
26	28°77.5	10°33.1	08.64	44.68	- .32	- .15	+ .04	23.53
27	28°95.3	10°51.2	08.66	44.60	+ .18	- .11	+ .05	24.18
28	27°87.6	10°44.2	08.68	44.44	- .10	- .11	+ .05	24.08

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP III, PAIR 6.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "	' "	' "	' "	' "	° ' "
July 4	16°47'5	21°41'0	21 14 29'50	+1 54'48	+ '20	+ '03	+ '05	21 16 24'26
8	15°86'6	20°77'7	30'46	53'93	— '03	+ '03	+ '05	24'44
17	15°64'2	20°49'6	32'72	52'61	— '83	+ '03	+ '05	24'58
18	16°70'6	21°49'7	32'97	51'14	— '03	+ '03	+ '05	24'16
22	15°47'8	20°30'5	33'86	51'98	— '91	— '01	+ '04	24'96
23	16°07'3	20°73'1	34'06	48'06	+2'03	+ '03	+ '05	24'23
26	16°52'8	21°22'7	34'72	49'01	+1'07	+ '03	+ '05	24'88
27	15°59'5	20°62'1	34'96	49'64	— '58	+ '03	+ '05	24'10
30	16°51'8	21°19'7	35'75	48'55	+ '12	+ '03	+ '05	24'50
Aug. 2	15°97'2	20°61'5	36'46	47'71	— '06	+ '03	+ '05	24'19
5	16°57'8	21°24'2	37'00	48'20	— '83	— '05	+ '06	24'38
6	15°78'1	20°39'3	37'17	46'99	+ '18	+ '03	+ '05	24'42
10	16°38'5	21°01'2	37'96	47'34	— '88	+ '03	+ '05	24'50
13	16°09'6	20°60'3	38'66	44'56	+1'30	+ '03	+ '05	24'60
14	15°75'6	20°31'3	38'86	45'72	— '56	+ '03	+ '05	24'10
15	16°66'0	21°22'0	39'07	45'78	— '88	+ '03	+ '05	24'05
16	16°58'2	21°08'0	39'26	44'35	+ '77	+ '03	+ '05	24'46
20	17°25'1	21°72'9	39'86	43'88	+ '21	— '01	+ '04	23'98
23	16°32'3	20°76'5	40'36	43'05	+ '79	+ '03	+ '05	24'28
25	16°27'9	20°65'3	40'75	41'47	+1'94	+ '03	+ '05	24'24
26	16°13'3	20°56'1	40'96	42'72	+ '60	+ '03	+ '05	24'36
29	16°62'3	20°90'0	41'38	39'22	+3'26	+ '03	+ '05	23'94
31	16°50'8	20°95'4	41'74	43'14	— '96	+ '03	+ '05	24'00
Sept. 2	16°40'3	20°65'2	41'94	38'57	+3'40	+ '03	+ '05	23'99
6	16°22'2	20°64'1	42'42	42'51	— '69	+ '03	+ '05	24'32
9	15°93'3	20°22'3	42'88	39'52	+1'46	+ '03	+ '05	23'94
12	15°86'4	20°13'1	43'27	38'99	+1'74	+ '03	+ '05	24'08
18	16°87'5	21°18'0	43'71	39'87	+ '40	+ '03	+ '05	24'06
19	16°53'9	20°84'4	43'80	39'87	+ '06	+ '03	+ '05	23'81
23	16°64'4	20°85'9	44'26	37'78	+1'85	+ '03	+ '05	23'97
26	16°27'9	20°56'5	44'50	39'43	+ '35	+ '03	+ '05	24'36
27	16°46'3	20°70'1	44'52	38'32	+ '84	+ '03	+ '05	23'76
28	15°88'3	20°14'8	44'56	38'94	+ '46	+ '03	+ '05	24'04

GROUP III, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "	" "	" "	" "	" "	° ' "
July 8	17°57'7	22°60'4	21 14 28.04	+1 56.62	— .16	+ .05	+ .05	21 16 24.60
17	16°59'7	21°56'3	30.26	55.20	— 1.52	+ .03	+ .05	24.02
18	16°70'7	21°60'9	30.52	53.72	— .85	+ .03	+ .06	23.48
23	16°27'2	21°05'8	31.60	51.03	+ 1.06	+ .05	+ .08	23.82
26	17°01'4	21°81'5	32.25	51.38	+ .06	+ .03	+ .05	23.77
27	16°56'8	21°40'9	32.48	52.30	— 1.32	+ .03	+ .04	23.53
30	16°78'2	21°61'5	33.26	52.12	— 1.75	+ .03	+ .06	23.72
Aug. 2	15°73'6	21°51'4	33.98	50.84	— 1.08	+ .03	+ .05	23.82
3	16°14'1	21°91'4	34.17	50.73	— 1.23	+ .03	+ .05	23.75
5	16°66'9	21°42'9	34.52	50.42	— 1.10	+ .03	+ .05	23.92
7	16°49'0	21°20'3	34.86	49.34	+ .35	+ .03	+ .05	24.63
13	16°62'6	21°26'4	36.16	47.60	+ .10	+ .03	+ .05	23.94
14	17°34'9	21°99'2	36.36	47.71	— .97	+ .03	+ .05	23.18
15	16°65'2	21°38'9	36.59	49.89	— 2.82	+ .03	+ .05	23.74
16	16°97'1	21°57'7	36.78	46.85	— .18	+ .03	+ .05	23.53
20	17°65'3	22°27'2	37.38	47.15	— .85	+ .03	+ .05	23.76
22	17°10'0	21°73'6	37.70	47.55	— 1.11	+ .03	+ .05	24.22
25	18°21'0	22°62'7	38.28	46.85	— 1.19	+ .03	+ .05	24.02
26	17°57'2	22°12'3	38.48	45.58	— .42	+ .03	+ .05	23.72
29	17°54'5	22°01'0	39.04	43.58	+ .80	+ .03	+ .05	23.50
31	17°07'8	21°66'3	39.28	46.36	— 1.64	+ .03	+ .05	24.08
Sept. 2	17°91'3	22°30'9	39.48	41.98	+ 1.56	+ .03	+ .05	23.10
6	17°32'1	21°83'5	39.98	44.72	— 1.17	+ .03	+ .05	23.61
9	17°89'6	22°26'9	40.45	41.45	+ 1.74	+ .03	+ .05	23.72
12	18°00'7	22°38'8	40.86	41.63	+ .94	+ .05	+ .05	23.53
15	17°43'9	21°37'8	41.10	42.98	— .18	+ .03	+ .05	23.98
18	16°92'5	21°34'7	41.32	42.58	— .20	+ .05	+ .05	23.80
19	17°49'2	21°93'1	41.42	42.98	— .71	+ .03	+ .05	23.77
23	17°85'7	22°20'8	41.90	40.94	+ .42	+ .01	+ .05	23.32
26	18°05'1	22°47'0	42.16	42.51	— .70	+ .03	+ .05	24.05
27	17°35'3	21°73'9	42.19	41.75	— .66	+ .06	+ .06	23.40
28	17°54'1	21°92'5	42.23	41.70	— .19	+ .03	+ .05	23.82

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP III, PAIR 8.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "					° ' "
July. 4	25°78'4	14°82'3	21 20 38.92	—4 14.28	— .08	— .08	+ .06	2L 16 24.54
8	24°95'5	13°94'1	39.86	15.51	— .25	— .08	+ .06	24.08
17	24°10'4	13°04'9	42.06	16.46	— 1.42	— .08	+ .06	24.16
18	24°82'0	13°71'0	42.32	17.74	— .47	— .08	+ .06	24.09
22	26°02'8	14°93'0	43.21	17.46	— 1.45	— .08	+ .06	24.28
23	25°03'1	13°78'5	43.40	20.89	+ 1.29	— .08	+ .06	23.78
26	24°34'0	13°10'9	44.05	20.54	+ .41	— .08	+ .06	23.90
27	24°66'1	13°48'0	44.28	19.38	— .68	— .08	+ .06	24.20
30	24°92'0	13°70'9	45.56	20.08	— .66	— .08	+ .06	24.80
Aug. 2	24°72'8	13°47'2	45.77	21.12	— .70	— .03	+ .08	24.00
3	25°29'3	14°04'0	45.97	21.05	— .36	— .08	+ .06	24.54
5	24°75'8	13°50'3	46.34	21.10	— 1.17	— .08	+ .06	24.05
6	24°80'0	13°49'5	46.49	22.26	+ .27	— .13	+ .09	24.46
7	24°06'7	12°69'7	46.66	23.77	+ .97	— .08	+ .06	23.84
10	25°59'3	14°27'8	47.27	22.49	— 1.08	— .08	+ .06	23.68
13	24°61'9	13°22'4	47.96	24.35	+ .82	— .08	+ .06	24.41
14	24°51'3	13°12'7	48.17	24.14	— .25	— .08	+ .06	23.76
15	24°27'2	13°97'4	48.38	22.10	— 1.38	— .08	+ .06	24.88
16	24°90'5	13°50'7	48.57	24.42	+ .15	— .08	+ .06	24.28
20	24°82'1	13°37'9	49.18	25.44	+ .44	— .06	+ .05	24.17
22	25°21'4	13°82'7	49.50	24.16	— 1.02	— .08	+ .06	24.30
23	25°26'6	13°80'5	49.68	25.88	+ .26	— .08	+ .06	24.04
25	25°00'2	13°55'0	50.08	25.67	+ .36	— .08	+ .06	24.75
26	25°43'2	13°96'6	50.28	25.99	+ .29	— .08	+ .06	24.56
29	25°36'2	13°88'8	50.82	26.18	— .20	— .08	+ .06	24.42
31	24°18'9	13°73'8	51.09	25.65	— .74	— .08	+ .06	24.68
Sept. 2	24°68'9	13°09'4	51.30	28.99	+ 2.15	— .08	+ .06	24.44
9	25°32'6	13°75'1	52.27	28.52	+ .75	— .08	+ .06	24.48
12	24°77'3	13°14'8	52.69	29.68	+ 1.26	— .08	+ .06	24.25
15	24°05'8	13°46'2	52.94	29.01	+ .39	— .08	+ .06	24.30
18	25°61'0	14°04'3	53.18	28.34	— .56	— .08	+ .06	24.26
19	24°90'8	13°32'4	53.27	28.73	+ .14	— .08	+ .06	24.66
23	24°95'4	13°28'7	53.75	30.66	+ 1.07	— .08	+ .06	24.14
26	25°53'8	13°90'9	54.02	29.78	— .02	— .08	+ .06	24.20
27	24°55'9	12°92'4	54.06	29.92	+ .08	— .08	+ .06	24.20
28	25°65'7	14°03'0	54.11	29.73	— .06	— .08	+ .06	24.30

GROUP III, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "					° ' "
July 8	17°57'7	22°60'4	21 14 28.04	+1 56.62	- .16	+ .05	+ .05	21 16 24
17	16°59'7	21°56'3	30.26	55.20	-1.52	+ .03	+ .05	24
18	16°70'7	21°60'9	30.52	53.72	- .85	+ .03	+ .06	23
23	16°27'2	21°05'8	31.60	51.03	+1.06	+ .05	+ .08	23
26	17°01'4	21°81'5	32.25	51.38	+ .06	+ .03	+ .05	23
27	16°56'8	21°40'9	32.48	52.30	-1.32	+ .03	+ .04	23
30	16°78'2	21°61'5	33.26	52.12	-1.75	+ .03	+ .06	23
Aug. 2	15°73'6	21°51'4	33.98	50.84	-1.08	+ .03	+ .05	23
3	16°14'1	21°91'4	34.17	50.73	-1.23	+ .03	+ .05	23
5	16°66'9	21°42'9	34.52	50.42	-1.10	+ .03	+ .05	23
7	16°49'0	21°20'3	34.86	49.34	+ .35	+ .03	+ .05	24
13	16°62'6	21°26'4	36.16	47.60	+ .10	+ .03	+ .05	23
14	17°34'9	21°99'2	36.36	47.71	- .97	+ .03	+ .05	23
15	16°65'2	21°38'9	36.59	49.89	-2.82	+ .03	+ .05	23
16	16°97'1	21°57'7	36.78	46.85	- .18	+ .03	+ .05	23
20	17°65'3	22°27'2	37.38	47.15	- .85	+ .03	+ .05	23
22	17°10'0	21°73'6	37.70	47.55	-1.11	+ .03	+ .05	24
25	18°21'0	22°62'7	38.28	46.85	-1.19	+ .03	+ .05	24
26	17°57'2	22°12'3	38.48	45.58	- .42	+ .03	+ .05	23
29	17°54'5	22°01'0	39.04	43.58	+ .80	+ .03	+ .05	23
31	17°07'8	21°66'3	39.28	46.36	-1.64	+ .03	+ .05	24
Sept. 2	17°91'3	22°30'9	39.48	41.98	+1.56	+ .03	+ .05	23
6	17°32'1	21°83'5	39.98	44.72	-1.17	+ .03	+ .05	23
9	17°89'6	22°26'9	40.45	41.45	+1.74	+ .03	+ .05	23
12	18°00'7	22°38'8	40.86	41.63	+ .94	+ .05	+ .05	23
15	17°43'9	21°37'8	41.10	42.98	- .18	+ .03	+ .05	23
18	16°92'5	21°34'7	41.32	42.58	- .20	+ .05	+ .05	23
19	17°49'2	21°93'1	41.42	42.98	- .71	+ .03	+ .05	23
23	17°85'7	22°20'8	41.90	40.94	+ .42	+ .01	+ .05	23
26	18°05'1	22°47'0	42.16	42.51	- .70	+ .03	+ .05	24
27	17°35'3	21°73'9	42.19	41.75	- .66	+ .06	+ .06	23
28	17°54'1	21°92'5	42.23	41.70	- .19	+ .03	+ .05	23

REPORT FOR THE YEAR 1947

THE NATIONAL BUREAU OF INVESTIGATION
UNITED STATES DEPARTMENT OF JUSTICE

WASHINGTON, D. C.

No.	Name	Age	Sex	Race	Religion
1	John Doe	35	M	W	C
2	Jane Smith	28	F	W	C
3	Robert Johnson	42	M	W	C
4	Mary White	31	F	W	C
5	Charles Brown	25	M	W	C
6	Elizabeth Black	38	F	W	C
7	William Green	45	M	W	C
8	Patricia Gray	22	F	W	C
9	Thomas Hall	50	M	W	C
10	Sarah King	33	F	W	C
11	James Lee	27	M	W	C
12	Anna Miller	40	F	W	C
13	Frank Nelson	36	M	W	C
14	Grace Olsen	29	F	W	C
15	Harold Parker	48	M	W	C
16	Irene Quinn	32	F	W	C
17	George Reed	24	M	W	C
18	Helen Scott	37	F	W	C
19	Victor Taylor	41	M	W	C
20	Wendy Vance	26	F	W	C
21	Yvonne Ward	34	F	W	C
22	Zachary Webb	43	M	W	C
23	Adeline X	30	F	W	C
24	Bernard Y	21	M	W	C
25	Clara Z	46	F	W	C

GROUP IV, PAIR 1.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer, " "	
1891.			° ' "	' "	" "	" "	" "	° ' "
Aug. 20	13'77.2	23'96.7	21 12 28.52	+3 56.51	-1.00	+08	+06	21 16 24.17
22	13'08.0	23'37.7	28.88	58.87	-3.41	+08	+06	24.48
23	14'16.7	24'36.0	29.08	56.46	— .88	+08	+06	24.80
25	13'66.3	23'81.4	29.52	55.49	— .50	+08	+06	24.65
29	13'73.1	23'84.0	30.40	54.51	-1.39	+08	+06	23.66
31	13'57.0	23'79.1	30.75	57.11	-2.84	+08	+06	25.16
Sept. 2	14'07.9	24'16.8	31.04	54.05	— .57	+08	+06	24.66
6	13'65.7	23'65.5	31.62	51.94	+ .50	+08	+06	24.20
9	13'41.4	23'49.7	32.19	53.91	-1.58	+08	+06	24.66
12	13'75.6	23'77.8	32.73	52.49	-1.02	+08	+06	24.34
15	14'25.1	24'24.4	33.14	51.82	— .91	+08	+06	24.19
19	12'97.3	23'00.1	33.60	52.63	-2.31	+08	+06	24.06
23	13'66.8	23'62.2	34.22	50.92	-1.47	+08	+06	23.81
26	13'77.4	23'73.9	34.64	51.17	-1.68	+08	+06	24.27
27	13'95.4	23'87.5	34.75	50.15	-1.16	+08	+06	23.88
28	13'69.7	23'61.6	34.83	50.11	-1.12	+08	+06	23.96
Oct. 4	14'77.1	24'66.3	35.28	49.48	— .58	+08	+06	24.32
5	14'70.3	24'57.6	35.39	49.04	— .39	+08	+06	24.18
8	14'25.7	24'05.4	35.74	47.28	+ .93	+08	+06	24.09
10	14'63.7	24'48.5	35.93	48.46	— .39	+08	+06	24.14
16	15'28.3	25'10.0	36.19	47.74	— .01	+08	+06	24.06
17	14'59.7	24'42.3	36.25	47.95	— .72	+08	+06	23.62
28	13'70.4	23'62.5	36.69	50.15	-2.42	+06	+06	24.54
30	15'20.6	25'12.1	36.67	50.01	-2.14	+08	+06	24.68
31	15'22.8	25'02.1	36.68	47.18	+ .12	+08	+06	24.12
Nov. 1	14'45.4	24'33.7	36.70	49.27	-1.88	+08	+06	24.23
4	15'43.6	25'17.4	36.81	45.91	+1.32	+08	+06	24.18
6	14'59.8	24'38.2	36.85	46.97	+ .55	+08	+06	24.51
7	14'24.8	24'05.8	36.83	47.58	— .59	+08	+06	23.96
12	14'37.6	24'23.7	36.61	48.76	— .75	+08	+08	24.78
14	14'30.8	24'05.2	36.56	46.05	+1.15	+08	+06	23.90
16	15'33.2	25'23.0	36.55	49.62	-2.73	+08	+06	23.58
17	14'26.2	24.14.8	36.55	49.34	-1.63	+08	+06	24.40

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP IV, PAIR 2.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.								
Aug. 20	28° 84' 5	7° 05' 6	21 24 50' 15	—8 25' 47	—1' 39	—16	+06	21 16 23' 19
22	28° 58' 5	6° 66' 8	50' 52	28' 44	+1' 10	—14	+06	23' 10
23	29° 20' 2	7° 33' 3	50' 72	27' 33	—06	—16	+06	23' 23
25	29° 13' 9	7° 31' 3	51' 16	26' 33	—93	—16	+06	23' 80
29	29° 15' 2	7° 21' 6	52' 06	28' 88	+29	—16	+06	23' 37
31	29° 41' 3	7° 55' 1	52' 42	27' 16	—1' 26	—16	+06	23' 90
Sept. 2	29° 25' 4	7° 31' 0	52' 70	29° 07	+09	—16	+06	23' 62
6	29° 32' 9	7° 35' 7	53' 30	29° 72	+53	—16	+06	24° 01
9	29° 38' 4	7° 38' 7	53' 88	30' 30	+08	—16	+06	23' 56
12	28° 67' 6	6° 66' 8	54' 44	30° 55	—67	—16	+06	23' 12
15	29° 38' 3	7° 41' 3	54' 85	29° 67	—1' 58	—20	+04	23' 44
19	29° 01' 2	7° 01' 5	55' 33	30' 30	—1' 93	—16	+06	23' 00
23	28° 13' 8	6° 07' 6	55' 97	31' 80	—1' 23	—16	+06	22' 84
26	29° 18' 1	7° 14' 9	56' 40	31' 11	—1' 48	—16	+06	23' 71
27	29° 01' 7	6° 94' 1	56' 51	32' 13	—1' 40	—16	+06	22' 88
28	29° 50' 3	7° 42' 6	56' 60	32' 15	—97	—16	+06	23' 38
Oct. 4	29° 46' 2	7° 35' 5	57' 07	32' 85	—62	—13	+06	23' 53
5	29° 36' 6	7° 24' 9	57' 19	33' 08	—81	—16	+06	23' 20
8	29° 24' 3	7° 07' 0	57' 50	34' 38	+68	—16	+06	23' 70
10	29° 89' 3	7° 73' 3	57' 75	34' 08	+07	—16	+06	23' 64
17	29° 72' 8	7° 56' 3	58' 09	34' 20	—25	—24	+08	23' 48
28	29° 30' 2	7° 19' 2	58' 58	32' 92	—2' 52	—20	+04	22' 98
30	29° 54' 0	7° 44' 7	58' 57	32' 52	—1' 98	—16	+06	23' 96
31	29° 31' 5	7° 11' 1	58' 58	35' 10	+58	—16	+06	23' 96
Nov. 1	29° 19' 4	7° 08' 8	58' 61	32' 83	—1' 94	—16	+06	23' 74
4	29° 72' 1	7° 44' 3	58' 73	36' 82	+1' 79	—20	+04	23' 54
6	29° 54' 7	7° 34' 4	58' 78	35' 08	—29	—16	+06	23' 31
7	29° 41' 2	7° 24' 5	58' 77	34' 24	—1' 03	—24	+08	23' 34
10	29° 15' 8	6° 98' 3	58' 66	34' 43	—57	—16	+06	23' 56
12	29° 04' 2	6° 84' 5	58' 57	34' 94	—55	—16	+08	23' 00
14	30° 29' 0	8° 07' 0	58' 53	35' 47	+1' 24	—16	+08	24' 22
15	30° 00' 9	7° 84' 0	58' 53	34' 29	—61	—26	+08	23' 45
17	30° 84' 7	8° 58' 9	58' 53	36' 35	+1' 72	—16	+06	23' 80

GROUP IV, PAIR 3.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.			° ' "					° ' "
Aug. 20	19° 62' 1	18° 54' 8	21 16 47' 14	-0 24' 89	+ ' 47	-01	+05	21 16 22' 76
23	20° 46' 0	19° 37' 9	47' 75	25' 08	+ ' 89	-01	+05	23' 60
25	19° 98' 1	18° 82' 7	48' 21	26' 77	+1' 14	-01	+05	22' 62
29	19° 75' 1	18° 52' 4	49' 16	28' 46	+1' 79	-01	+05	22' 53
31	19° 64' 8	18° 44' 6	49' 55	27' 88	+1' 19	-01	+05	22' 90
Sept. 2	19° 82' 9	18° 64' 3	49' 88	27' 51	+ ' 79	-01	+05	23' 20
6	19° 53' 0	18° 25' 8	50' 52	29' 51	+2' 81	-01	+05	23' 86
9	19° 69' 6	18° 42' 7	51' 13	29' 44	+ ' 62	-05	+04	22' 30
12	19° 72' 5	18° 41' 6	51' 73	30' 37	+1' 42	-01	+05	22' 82
15	19° 93' 5	18° 64' 2	52' 20	30' 00	+ ' 78	-01	+05	23' 02
19	19° 80' 0	18° 52' 9	52' 73	29' 48	- ' 44	-01	+05	22' 85
23	19° 95' 9	18° 57' 4	53' 40	32' 13	+1' 09	-01	+05	22' 40
26	19° 32' 5	17° 95' 5	53' 89	31' 78	+1' 02	-01	+05	23' 17
27	19° 45' 8	17° 09' 5	54' 02	31' 62	+ ' 59	-01	+05	23' 03
28	19° 54' 2	18° 12' 8	54' 12	32' 80	+1' 53	-01	+05	22' 89
Oct. 4	20° 09' 7	19° 67' 2	54' 66	33' 06	+1' 84	-01	+05	23' 48
5	19° 78' 2	18° 35' 6	54' 78	33' 08	+ ' 96	-01	+05	22' 70
8	19° 54' 1	18° 04' 5	55' 18	34' 70	+2' 48	-01	+05	23' 00
10	19° 65' 0	18° 22' 9	55' 40	32' 96	+ ' 58	-01	+05	23' 06
14	19° 65' 7	18° 15' 2	55' 65	34' 91	+2' 20	-01	+05	22' 98
16	19° 80' 2	18° 31' 0	55' 76	34' 61	+1' 22	-05	+04	22' 36
22	19° 93' 1	18° 49' 0	56' 28	33' 43	+ ' 44	-03	+05	23' 31
28	20° 27' 8	18° 91' 5	56' 43	31' 62	- ' 93	-01	+06	23' 93
30	20° 01' 6	18° 61' 3	56' 44	32' 55	- ' 45	-01	+05	23' 48
31	19° 71' 1	18° 16' 2	56' 45	35' 94	+2' 38	-01	+05	22' 93
Nov. 1	19° 82' 2	18° 39' 6	56' 48	33' 08	- ' 58	-01	+05	22' 86
4	19° 89' 5	18° 34' 2	56' 63	36' 03	+2' 64	-01	+05	23' 28
6	19° 94' 3	18° 47' 7	56' 70	34' 01	+ ' 47	-01	+05	23' 20
7	19° 94' 0	18° 46' 7	56' 70	34' 17	+ ' 12	-01	+03	22' 67
10	19° 88' 3	18° 40' 4	56' 62	34' 31	+ ' 50	-01	+05	22' 85
14	20° 65' 7	19° 15' 5	56' 51	34' 84	+1' 68	-01	+05	23' 39
17	20° 49' 7	19° 00' 5	56' 53	34' 61	+1' 23	-01	+05	23' 19

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP IV, PAIR 4.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. "	Ref. "	Mer. "	
1891.								
Aug. 20	14°26'9	21°55'5	21 13 35°54	+2 49'02	— '55	+ '05	+ '06	21 16 24°12
23	14°66'6	21°92'3	36°13	48'35	— '23	+ '05	+ '06	24°36
25	15°16'6	22°37'3	36°58	47'19	+ '10	+ '05	+ '06	23°08
29	14°05'6	21°21'2	37°51	46°01	+ '44	+ '05	+ '06	24°07
31	13°64'9	20°84'8	37°89	47°01	— '65	+ '05	+ '06	24°36
Sept. 2	14°27'1	21°42'9	38°21	46°06	— '23	+ '05	+ '06	24°15
9	14°58'4	21°72'9	39°43	45°75	— 1°32	+ '05	+ '06	23°97
12	14°76'0	21°80'3	40°02	43°39	+ '58	+ '05	+ '06	24°10
15	13°86'4	20°91'4	40°49	43°55	— '18	+ '01	+ '05	23°02
19	15°03'0	22°10'2	41°00	44°06	— 1°07	+ '05	+ '06	24°10
23	14°24'5	21°24'6	41°67	42°41	— '38	+ '05	+ '06	23°81
26	14°69'9	21°68'5	42°16	42°06	— '33	+ '05	+ '06	24°00
27	13°82'0	20°81'0	42°29	42°16	— '20	+ '05	+ '06	24°36
28	14°77'5	21°72'9	42°39	41°32	— '26	+ '05	+ '06	23°56
Oct. 4	15°17'6	22°08'2	42°92	40°21	+ '86	+ '05	+ '06	24°10
5	14°52'9	21°45'5	43°04	40°67	+ '08	+ '05	+ '06	23°90
8	15°01'4	21°87'1	43°44	39°07	+ 1°18	+ '05	+ '06	23°80
14	15°21'1	22°04'6	43°94	38°56	+ 1°23	+ '05	+ '06	23°84
16	15°96'6	21°80'5	44°05	38°66	+ 1°02	+ '05	+ '06	23°84
22	15°02'7	21°89'9	44°58	39°42	'00	+ '05	+ '06	24°11
28	15°02'2	21°92'4	44°75	40°12	— '84	+ '05	+ '06	24°14
30	14°27'0	21°16'5	44°77	39°95	— '42	+ '09	+ '05	24°44
31	14°57'9	21°34'5	44°79	36°96	+ 2°21	+ '05	+ '06	24°07
Nov. 1	15°02'2	21°89'5	44°83	39°44	— '55	+ '05	+ '06	23°83
4	14°94'2	21°81'7	44°98	39°49	— '68	+ '05	+ '06	23°90
6	15°55'6	22°38'1	45°06	38°33	+ 1°18	+ '05	+ '06	24°68
7	14°79'4	21°65'7	45°07	39°21	— '76	+ '01	+ '05	23°58
10	14°59'2	21°43'1	45°02	38°66	— '41	+ '05	+ '06	23°38
14	15°59'8	22°39'2	44°93	37°61	+ '86	+ '01	+ '05	23°46
15	16°24'6	23°01'7	44°94	37°08	+ 1°39	+ '05	+ '06	23°52
17	16°14'0	22°98'2	44°97	38°72	+ '18	+ '05	+ '06	23°98

GROUP IV, PAIR 5.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.			• ' "					• ' "
Aug. 20	25°46'0	12°78'2	21 21 20'33	-4 54'11	-1'56	-08	+05	21 16 24'63
23	25°63'2	12°85'3	20'94	56'45	+ '30	-08	+05	24'76
25	25°80'2	13°00'9	21'41	56'78	- '08	-08	+05	24'52
29	25°76'5	12°90'2	22'39	58'40	+ '46	-08	+05	24'42
31	25°18'7	13°38'9	22'81	57'06	- '90	-08	+05	24'82
Sept. 2	26°23'0	13°42'9	23'14	56'96	-1'11	-08	+05	25'04
6	25°91'6	12°98'6	23'81	59'96	+ '50	-08	+05	24'32
9	25°92'4	13°09'5	24'43	57'61	-2'12	-08	+05	24'67
12	25°74'4	12°78'5	25'07	60'63	+ '49	-08	+05	24'90
15	25°45'3	12°53'9	25'58	59'59	-1'74	-08	+05	24'22
23	26°40'2	13°40'6	26'86	-5 01'49	-1'22	-08	+05	24'12
26	25°78'8	12°78'2	27'38	01'72	-1'45	-08	+05	24'18
28	25°20'5	12°16'4	27'64	02'53	- '50	-08	+05	24'58
Oct. 4	26°40'4	13°32'3	28'24	03'46	+ '25	-08	+05	25'00
5	26°24'3	13°17'2	28'37	03'23	- '43	-08	+05	24'68
8	25°89'4	12°73'2	28'81	05'34	+1'11	-08	+05	24'55
10	26°05'7	12°94'9	29'07	04'09	- '32	-08	+05	24'63
16	25°40'6	12°25'1	29'52	05'18	+ '45	-08	+05	24'76
22	25°63'2	12°49'5	30'12	04'76	-1'22	-05	+07	24'16
28	25°59'4	12°51'7	30'38	03'37	-1'92	-08	+05	25'06
30	25°51'1	12°41'0	30'42	03'92	-1'77	-08	+05	24'70
31	26°28'1	13°01'2	30'45	07'82	+1'73	-08	+05	24'33
Nov. 1	26°72'8	13°62'5	30'49	03'97	-1'79	-08	+05	24'70
4	25°70'3	12°48'7	30'68	06'59	+ '28	-08	+05	24'34
6	25°79'8	12°60'3	30'79	06'10	- '24	-08	+05	24'42
7	25°53'7	12°39'3	30'81	04'92	-1'42	-08	+05	24'44
13	26°21'2	13°06'0	30'74	05'11	-1'00	-08	+05	24'60
14	26°46'7	13°25'7	30'75	06'45	+ '19	-08	+05	24'46
17	27°23'6	14°07'6	30'82	05'29	- '67	08	+05	24'83

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP IV, PAIR 6.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "			
1891.			° ' "					° ' "		
Aug. 20	10°06'2	26°23'0	21 10 10°18	+6 15'07	-1'41	+·11	+·07	21 16 24°02		
23	10°30'9	26°35'0	10°75	12'13	+·88	+·11	+·07	23°94		
25	10°16'8	26°21'2	11°20	12'20	+·50	+·11	+·07	24°08		
29	10°77'4	26°76'7	12°13	11'01	+·26	+·11	+·07	23°58		
31	10°76'0	26°75'1	12°53	10'97	+·55	+·11	+·07	24°23		
Sept. 2	10°53'0	26°56'5	12°86	11'99	-1'25	+·11	+·07	23°78		
6	10°66'9	26°58'4	13°48	09'20	+1'16	+·11	+·07	24°02		
9	11°04'1	27°06'0	14°06	11'62	-2'08	+·11	+·07	23°78		
12	10°78'8	26°69'6	14°68	09'04	+·02	+·11	+·07	23°92		
15	10°26'5	26°13'8	15°18	08'23	+·13	+·11	+·07	23°72		
19	10°51'3	26°42'6	15°71	09'16	-1'55	+·11	+·07	23°50		
23	10°57'7	26°30'3	16°39	04'82	+2'49	+·11	+·07	23°88		
26	10°11'4	25°98'7	16°90	08'23	-1'80	+·11	+·07	23°51		
27	10°51'4	26°31'5	17°04	06'56	-·34	+·11	+·07	23°44		
28	9°92'2	25°69'3	17°16	05'86	-·18	+·07	+·05	22°96		
Oct. 4	10°69'8	26°45'1	17°73	05'45	+·33	+·11	+·07	23°69		
5	10°75'1	26°52'9	17°86	06'03	+·12	+·11	+·07	24°19		
8	10°57'8	26°26'3	18°29	03'87	+1'17	+·11	+·07	23°51		
10	9°77'5	25°54'3	18°54	05'79	-·59	+·11	+·07	23°92		
16	10°90'4	26°54'4	19°00	02'82	+1'18	+·11	+·07	23°18		
22	10°75'0	26°45'0	19°61	04'22	-·65	+·13	+·07	23°38		
28	10°53'0	26°24'2	19°90	04'49	-1'74	+·11	+·07	22°83		
30	10°24'2	25°99'1	19°94	05'35	-1'45	+·11	+·07	24°02		
31	10°80'0	26°37'7	19°97	01'36	+2'12	+·15	+·05	23°65		
Nov. 1	10°36'5	26°12'4	20°02	05'58	-2'26	+·11	+·07	23°52		
4	10°88'5	26°51'2	20°22	02'52	+·38	+·11	+·07	23°30		
6	10°73'6	26°38'3	20°35	02'99	+·22	+·11	+·07	23°74		
10	10°62'6	26°28'0	20°40	03'15	-·97	+·11	+·07	22°76		
12	10°38'5	26°06'0	20°37	03'64	-1'34	+·11	+·07	22°85		
13	11°34'7	26°99'4	20°38	02'99	+·13	+·11	+·07	23°68		
14	12°44'5	28°06'3	20°38	02'31	+1'07	+·11	+·07	23°94		
17	12°25'3	27°88'6	20°48	02'66	+·12	+·11	+·07	23°44		

GROUP IV, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "			
1891.			° ' "					° ' "		
Aug. 20	25°46'6	12°22'7	21 21 32.86	-5 07.12	-1.51	-10	+06	21 16 24.19		
23	25°10'6	11°77'1	33.43	09.35	+35	-10	+06	24.39		
25	25°59'4	12°27'5	33.87	08.98	-06	-10	+06	24.79		
29	25°06'5	12°56'8	34.82	10.79	+31	-14	+04	24.24		
31	25°67'4	12°24'9	35.24	11.44	+47	-10	+06	24.23		
Sept. 2	25°84'4	12°51'7	35.57	09.17	-1.54	-10	+06	24.82		
6	25°80'3	12°34'5	36.21	12.21	+42	-10	+06	24.38		
9	26°06'9	12°66'2	36.81	11.02	-1.05	-10	+06	24.70		
12	25°69'5	12°21'7	37.43	12.67	-60	-10	+06	24.12		
15	25°78'8	12°30'1	37.96	12.88	-60	-10	+06	24.44		
19	25°66'5	12°23'4	38.52	11.58	-2.06	-10	+06	24.84		
23	25°42'8	11°81'4	39.22	15.82	+96	-10	+06	24.32		
26	25°29'7	11°76'4	39.75	13.95	-1.42	-10	+06	24.34		
27	25°64'9	12°09'4	39.91	14.46	-95	-14	+04	24.40		
28	25°26'3	11°67'1	40.03	15.31	-28	-10	+06	24.40		
Oct. 4	26°07'1	12°44'2	40.65	16.17	+04	-10	+06	24.48		
5	26°11'0	12°45'0	40.78	16.89	+45	-10	+06	24.30		
8	26°23'5	12°55'2	41.23	17.43	+84	-10	+06	24.60		
10	25°69'5	12°08'4	41.51	15.76	-99	-10	+06	24.72		
16	25°36'9	11°65'4	42.04	18.17	+59	-10	+06	24.42		
22	25°84'4	12°16'8	42.70	17.26	-1.42	-10	+06	23.98		
28	25°80'2	12°15'1	43.07	16.68	-2.51	-06	+04	23.86		
30	26°47'5	12°81'1	43.12	16.98	-1.40	-10	+06	24.70		
31	26°14'7	12°31'8	43.16	20.81	+1.80	-10	+06	24.11		
Nov. 1	26°05'8	12°43'9	43.22	15.94	-2.53	-10	+06	24.71		
4	26°45'3	12°71'3	43.45	18.75	+14	-10	+06	24.80		
6	26°07'2	12°34'5	43.61	18.44	-45	-10	+06	24.68		
7	25°03'5	12°24'1	43.66	17.68	-1.88	-12	+06	24.04		
12	25°88'2	12°16'2	43.71	18.28	-1.56	-16	+08	23.79		
13	26°24'1	12°47'8	43.72	19.28	-26	-10	+06	24.14		
14	26°89'8	13°13'8	43.74	19.21	00	-10	+06	24.49		
17	27°45'4	13°71'7	43.87	18.68	-56	-10	+06	24.59		

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP IV, PAIR 8.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.								
Aug. 20	15°52'6"	23°45'1"	21 13 21'66"	+3 03'85"	-1'21"	+05	+05	21 16 24'40"
23	15°18'8"	23°00'6"	22'24"	01'37"	00	+05	+05	23'71"
25	15°60'7"	23°40'1"	22'70"	00'81"	+12	+05	+05	23'73"
29	15°93'3"	23°64'3"	23'67"	+2 58'86"	+81	+05	+05	23'44"
31	14°83'0"	22°50'7"	24'12"	58'10"	+19	+01	+04	22'46"
Sept. 2	15°36'9"	23°14'8"	24'47"	60'46"	-1'21"	+05	+05	23'82"
6	15°54'3"	23°22'5"	25'13"	58'21"	+50	+05	+05	23'94"
9	15°67'9"	23°32'8"	25'74"	57'45"	+20	+05	+05	23'49"
12	15°17'8"	22°82'6"	26'40"	57'42"	-20	+05	+05	23'72"
15	15°23'6"	22°88'7"	26'95"	57'49"	-1'17"	+05	+05	23'37"
19	16°02'5"	23°66'1"	27'54"	57'14"	-1'70"	+05	+05	23'08"
23	15°68'7"	23°21'5"	28'25"	54'64"	+85	+05	+05	23'84"
26	15°28'0"	22°84'7"	28'81"	55'54"	-1'13"	+05	+05	23'32"
27	14°31'9"	21°87'2"	28'98"	55'22"	-65	+05	+05	23'65"
28	15°41'9"	22°94'4"	29'11"	54'57"	-34	+05	+05	23'44"
Oct. 4	15°76'3"	23°26'1"	29'76"	53'94"	+09	+05	+05	23'89"
5	15°95'7"	23°42'3"	29'90"	53'20"	+40	+05	+05	23'60"
8	15°47'9"	22°92'1"	30'37"	52'64"	+53	+05	+05	23'64"
16	14°85'4"	22°26'7"	31'23"	51'97"	+52	+05	+05	23'82"
22	15°55'0"	23°04'2"	31'90"	53'80"	-1'71"	+05	+05	24'09"
28	15°66'1"	23°15'9"	32'31"	53'94"	-2'81"	+05	+05	23'54"
30	15°63'9"	23°08'6"	32'37"	52'76"	-1'67"	+05	+05	23'56"
31	15°66'4"	22°97'1"	32'42"	49'51"	+2'19"	+05	+05	24'22"
Nov. 1	17°63'0"	25°10'8"	32'47"	53'27"	-2'17"	+05	+05	23'67"
4	15°59'5"	22°95'9"	32'71"	50'83"	-46	+05	+05	23'18"
6	15°69'0"	23°03'4"	32'88"	50'37"	+43	+05	+05	23'78"
7	15°29'4"	22°71'3"	32'93"	52'11"	-2'20"	+05	+07	22'96"
12	15°20'2"	22°61'5"	33'01"	51'97"	-1'41"	+05	+05	23'67"
13	15°66'1"	23°03'9"	33'02"	51'16"	+44	+05	+05	24'72"
14	16°10'9"	23°42'5"	33'04"	49'72"	+60	+05	+05	23'46"
14	16°89'9"	23°30'0"	33'18"	51'69"	-1'03	+05	+05	23'94"
7								

GROUP V, PAIR I.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. "	Ref. "	Mer. "	
1891.								
Oct. 4	19-45-8	20-01-3	21 16 09-44	+0 12-88	+1-54	00	+06	21 16 23-92
5	18-46-9	19-53-7	09-57	13-18	+1-01	00	+06	23-82
8	19-51-5	20-05-7	10-02	12-57	+1-49	00	+06	24-14
16	19-43-9	19-93-3	10-98	11-46	+1-45	00	+06	23-95
30	19-72-8	20-25-3	12-29	12-18	-1-26	00	+06	23-27
31	19-90-3	20-27-5	12-34	08-63	+3-05	00	+06	24-08
Nov. 1	17-90-2	18-42-3	12-39	12-09	-86	00	+06	23-68
6	17-92-6	18-40-3	12-88	11-07	00	00	+06	24-01
12	18-13-4	18-60-8	13-20	11-00	-22	-08	+10	24-00
13	18-33-2	19-75-8	13-24	9-88	+91	00	+06	24-09
14	18-09-2	18-47-7	13-27	8-93	+1-66	00	+06	23-92
17	18-07-6	19-41-7	13-44	10-23	+0-53	00	+06	24-26
19	18-70-6	19-09-4	13-60	9-00	+1-31	00	+06	23-97
21	18-74-0	19-17-5	13-71	10-09	+62	-08	+10	24-44
23	19-12-6	19-42-6	13-76	6-96	+3-06	00	+06	23-84
30	18-80-3	19-27-5	13-76	10-95	-99	00	+06	23-78
Dec. 5	18-94-5	19-35-1	13-96	09-42	+24	00	+06	23-68
10	19-37-2	19-82-9	13-86	10-60	-29	00	+06	24-23
12	18-89-3	19-34-4	13-81	10-46	-39	00	+06	23-94
13	19-33-2	19-75-6	13-82	09-84	+32	00	+06	24-04
15	18-43-4	18-78-7	13-84	08-19	+1-91	00	+06	24-00
17	18-48-0	18-83-4	13-88	08-21	+1-71	00	+06	23-86
21	17-94-8	18-32-2	13-76	08-68	+1-84	00	+06	24-34
23	18-64-0	19-03-6	13-63	09-19	+0-88	-04	+04	23-70
24	18-59-5	18-98-8	13-57	09-12	+0-59	00	+06	23-34
25	18-69-5	19-07-4	13-50	08-79	+1-51	00	+06	23-86
26	18-88-4	19-34-1	13-46	10-60	-03	00	+06	24-09
27	18-63-5	19-16-5	13-42	09-98	+36	-02	+06	23-80
29	18-35-5	18-68-4	13-40	07-63	+2-80	00	+06	23-89
30	18-44-0	18-85-8	13-38	09-70	+62	00	+06	23-76
1892.								
Jan. 1	18-74-2	19-16-8	13-34	09-88	+31	-10	+10	23-53

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP V, PAIR 2.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.								
Oct. 4	28-48.4	10-96.6	21 23 09.66	-6 46.39	+ .83	-.12	+.06	21 16 24.04
5	28-54.7	10-96.7	09.78	47.83	+2.01	-.12	+.06	23.90
8	28-69.0	11-11.5	10.26	47.71	+1.77	-.10	+.05	24.27
16	29-36.1	11-71.0	11.28	50.48	+2.72	-.12	+.06	23.46
28	29-12.3	11-53.1	12.57	48.11	-.03	-.12	+.06	24.37
30	29-09.1	11-47.8	12.66	48.60	+.04	-.12	+.06	24.04
31	28-66.2	10-92.3	12.72	51.52	+3.10	-.12	+.06	24.24
Nov. 1	28-76.3	11-12.2	12.78	49.24	+.60	-.12	+.06	24.08
4	28-73.4	11-08.1	13.06	49.52	+.36	-.12	+.06	23.84
6	29-86.3	12-21.0	13.28	49.52	+.06	-.12	+.06	23.76
13	28-92.2	11-23.8	13.46	50.24	+.28	-.12	+.06	23.44
14	29-80.1	12-06.1	13.70	51.54	+1.78	-.12	+.06	23.88
17	29-63.7	11-94.2	13.88	50.50	+.53	-.16	+.04	23.79
19	29-42.5	11-70.2	14.04	51.15	+1.03	-.12	+.06	23.86
21	30-18.8	12-58.4	14.16	48.39	-1.97	-.12	+.06	23.74
23	29-11.8	11-34.5	14.22	52.31	+1.94	-.12	+.06	23.79
30	29-03.3	11-35.4	14.22	50.13	-.67	-.12	+.06	23.36
Dec. 5	28-66.6	10-99.8	14.43	49.87	-.52	-.12	+.06	23.98
6	28-21.6	10-56.1	14.44	49.57	-1.23	-.12	+.06	23.58
9	29-07.2	11-37.8	14.38	50.48	+.25	-.12	+.06	24.09
10	29-33.5	11-72.1	14.34	48.62	-1.46	-.10	+.06	24.22
12	28-89.0	11-24.2	14.30	49.41	-1.06	-.12	+.06	23.77
13	28-49.7	10-81.5	14.30	50.20	-.01	-.12	+.06	24.03
15	29-81.8	12-07.0	14.32	51.73	+1.17	-.12	+.06	23.70
17	28-34.5	10-62.9	14.36	50.98	+.68	-.12	+.06	24.00
19	28-42.8	10-63.1	14.34	52.86	+2.19	-.11	+.03	23.59
21	29-44.5	11-73.4	14.25	50.87	+.67	-.12	+.06	23.99
23	29-00.7	11-31.7	14.11	50.38	+.57	-.12	+.06	24.24
24	28-91.6	11-23.2	14.05	50.24	+.29	-.12	+.06	24.04
25	29-26.2	11-57.5	13.98	50.31	+.47	-.12	+.06	24.08
26	29-66.0	11-99.2	13.94	49.87	+.08	-.12	+.06	24.09
27	28-60.6	10-91.1	13.89	50.50	-.24	-.12	+.06	23.09
28	28-62.1	10-94.3	13.88	50.10	+.12	-.12	+.06	23.84
29	28-23.4	10-50.0	13.86	51.40	+1.06	-.12	+.06	23.46
30	29-28.9	11-62.0	13.84	49.89	+.05	-.12	+.06	23.94
1892.								
Jan. 1	28-97.0	11-29.0	13.81	50.15	+.36	-.12	+.02	23.92
5	28-58.6	10-95.9	13.54	48.92	+.03	-.12	+.06	24.59

GROUP V, PAIR 3.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.								
Oct. 4	22-81.2	17-06.8	21 18 37.36	-2 13.25	+ .38	-.04	+ .05	21 16 24.50
5	23-07.6	17-29.5	37.48	14.11	+1.30	-.04	+ .05	24.68
8	22-56.4	16-75.1	37.94	14.85	+1.38	-.04	+ .05	24.48
16	21-89.3	16-09.9	38.96	14.41	+0.41	-.04	+ .05	24.97
22	22-32.4	16-45.7	39.66	16.10	+1.22	-.00	+ .04	24.82
30	23-06.1	17-22.8	40.35	15.32	+ .15	-.04	+ .05	25.19
31	22-64.0	16-78.2	40.40	15.90	+ .06	-.04	+ .05	24.57
Nov. 1	22-74.9	16-91.0	40.46	15.46	-.27	-.04	+ .05	24.74
4	22-32.0	16-49.3	40.74	15.18	-.83	-.04	+ .05	24.74
6	22-74.7	16-86.5	40.97	16.45	+ .13	-.04	+ .05	24.66
12	22-81.5	16-95.0	41.34	16.06	-.21	-.06	+ .05	25.06
13	22-33.1	16-41.1	41.37	17.34	+1.43	-.04	+ .05	25.47
14	23-27.3	17-32.6	41.40	17.96	+1.40	-.04	+ .05	24.85
17	22-77.5	16-86.6	41.60	17.08	+ .24	-.04	+ .05	24.77
19	22-79.0	16-83.6	41.76	18.12	+1.10	-.08	+ .04	24.70
21	23-03.7	17-22.4	41.89	14.85	-2.34	-.04	+ .05	24.71
23	23-16.9	17-23.2	41.96	17.73	+1.06	-.04	+ .05	25.30
30	21-83.5	15-93.9	41.99	16.78	-.39	-.04	+ .05	24.83
Dec. 5	22-67.5	16-71.8	42.22	18.19	+ .41	-.04	+ .05	24.45
9	22-07.2	16-16.2	42.20	17.10	-.01	-.04	+ .05	25.10
10	22-35.7	16-47.1	42.17	16.55	-.77	-.04	+ .05	24.86
12	22-43.3	16-56.9	42.14	16.04	-.71	-.04	+ .05	25.40
13	22-20.8	16-29.6	42.14	17.15	-.19	-.04	+ .05	24.81
15	22-92.5	16-96.8	42.16	18.19	+1.08	-.04	+ .05	25.06
17	22-26.7	16-31.5	42.22	18.08	+ .81	-.04	+ .05	24.96
21	22-21.1	16-27.2	42.16	17.78	+ .30	-.04	+ .05	24.69
23	22-43.8	16-49.5	42.04	17.87	+ .08	-.04	+ .05	25.26
24	22-57.5	16-63.3	41.97	17.85	+ .61	-.04	+ .05	24.74
25	22-27.1	16-32.8	41.90	17.87	+ .98	-.04	+ .05	25.02
26	22-01.5	16-14.1	41.86	16.27	-.47	-.04	+ .05	25.13
29	22-81.4	16-85.8	41.82	18.17	+ .99	-.04	+ .05	24.65
30	22-56.9	16-65.4	41.82	17.22	+ .07	-.04	+ .05	24.68
1892.								
Jan. 2	23-18.0	17-30.3	41.76	16.34	+ .09	-.12	+ .06	25.45
5	22-51.9	16-70.5	41.58	14.88	-1.16	-.04	+ .05	25.55

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP V, PAIR 4.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. "	Level. "	Ref. "	Mer. "	
1891.			° ' "					° ' "
Oct. 4	7.78.7	29.33.1	21 08 04.32	+8 19.79	— .53	+ .15	+ .06	21 16 23.79
5	7.92.7	29.42.8	04.44	18.79	+ .32	+ .15	+ .06	23.76
8	8.77.2	30.26.3	04.88	18.56	+ .41	+ .15	+ .06	24.06
30	7.89.7	29.34.5	07.20	17.56	— 1.30	+ .15	+ .06	23.67
31	7.87.7	29.32.3	07.26	17.51	— 1.34	+ .15	+ .06	23.64
Nov. 1	7.92.2	29.41.0	07.30	18.49	— 1.42	+ .15	+ .06	24.58
4	8.09.3	29.52.7	07.58	17.24	— 1.21	+ .15	+ .06	23.82
6	7.80.2	29.25.1	07.80	17.58	— 1.48	+ .15	+ .06	24.11
13	8.01.8	29.34.8	08.21	14.82	+ .30	+ .15	+ .06	23.54
14	8.36.1	29.69.3	08.25	14.87	+ .76	+ .15	+ .06	24.09
17	8.31.1	29.69.2	08.44	16.01	— .59	+ .15	+ .06	24.07
19	8.78.8	30.13.9	08.60	15.31	— .16	+ .17	+ .05	23.97
21	8.84.6	30.33.6	08.74	18.54	— 3.29	+ .15	+ .06	24.20
23	8.85.9	30.18.2	08.82	14.66	+ .11	+ .15	+ .06	23.80
30	7.88.4	29.31.4	08.88	17.14	— 2.27	+ .15	+ .06	23.96
Dec. 5	8.09.0	29.46.0	09.14	15.75	— 1.22	+ .15	+ .06	23.88
6	8.27.4	29.65.3	09.16	15.96	— 1.30	+ .12	+ .06	24.00
9	8.40.0	29.80.8	09.14	16.63	— 1.79	+ .15	+ .06	24.19
10	7.67.5	29.12.7	09.12	17.65	— 2.39	+ .17	+ .05	24.60
12	7.37.3	28.82.1	09.09	17.56	— 2.42	+ .15	+ .06	24.44
15	7.75.7	29.08.6	09.14	14.80	— .27	+ .15	+ .06	23.88
19	8.33.3	29.61.1	09.22	13.62	+ .81	+ .11	+ .06	23.82
21	8.29.7	29.62.3	09.19	14.73	— .49	+ .15	+ .06	23.64
23	7.96.8	29.31.9	09.08	15.31	— .72	+ .15	+ .06	23.88
25	9.57.3	29.96.3	08.97	16.22	— 1.54	+ .15	+ .06	23.86
26	8.14.3	29.53.3	08.93	16.22	— 1.13	+ .15	+ .06	24.23
29	8.23.2	29.58.6	08.91	15.38	— .26	+ .17	+ .05	24.25
30	8.53.6	29.95.7	08.92	16.94	— 1.56	+ .15	+ .06	24.51
1892.								
Jan. 5	8.32.1	29.77.7	08.74	17.75	— 1.88	+ .11	+ .04	24.76

GROUP V, PAIR 5.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. "	Ref. "	Mer. "	
1891.			° ' "					° ' "
Oct. 4	25°44'7	14°87'7	21 20 29'33	-4 05'21	- .68	— .08	+ .06	21 16 23'42
5	24°77'2	14°15'0	29'44	06'41	+ .69	— .08	+ .06	23'70
8	25°30'6	14°67'9	29'88	06'53	+ .53	— .08	+ .06	23'86
16	24°63'2	14°03'0	30'84	05'95	— .49	— .08	+ .06	24'38
28	25°63'3	14°99'7	32'09	06'74	-1'80	— .08	+ .06	23'53
30	24°97'3	14°32'3	32'18	07'06	— .96	— .08	+ .06	24'14
31	25°17'7	14°53'7	32'23	06'83	-1'46	— .08	+ .06	23'92
Nov. 1	24°99'2	14°27'8	32'28	08'55	+ .09	— .08	+ .06	23'80
4	25°14'5	14°45'2	32'54	08'06	— .72	— .08	+ .06	23'74
6	25°76'5	15°05'8	32'77	08'39	— .59	— .08	+ .06	23'77
13	25°06'2	14°28'7	33'18	09'96	+ .42	— .08	+ .06	23'62
14	25°61'3	14°84'2	33'22	09'87	+ .56	— .08	+ .06	23'89
17	25°88'0	15°09'5	33'40	10'20	+ .94	— .08	+ .06	24'12
19	25°94'5	15°12'7	33'57	10'96	+1'45	— .08	+ .06	24'04
21	25°45'1	14°80'1	33'72	07'06	-2'39	— .08	+ .06	24'25
23	25°49'8	14°71'9	33'80	10'06	+ .48	— .08	+ .06	24'20
30	26°03'5	15°30'0	33'86	09'04	-1'40	— .08	+ .06	23'40
Dec. 1	25°29'5	14°42'9	33'91	12'07	+2'04	— .08	+ .06	23'86
5	25°37'0	14°63'0	34'14	09'15	-1'17	— .16	+ .08	23'74
6	25°33'0	14°60'2	34'16	18'87	-1'28	— .08	+ .06	23'99
9	25°11'1	14°38'1	34'16	08'92	-1'54	— .08	+ .06	23'68
10	25°48'1	14°71'3	34'14	09'80	— .37	— .08	+ .06	23'95
12	24°68'8	13°99'0	34'12	08'18	-1'66	— .08	+ .06	24'26
15	25°93'6	15°11'6	34'17	11'01	+ .69	— .08	+ .06	23'83
19	24°98'7	14°15'1	34'27	11'38	+1'16	— .08	+ .06	24'03
21	25°26'4	14°48'5	34'24	10'06	— .32	— .08	+ .06	23'84
23	25°37'9	14°61'5	34'14	09'71	— .85	— .08	+ .06	23'56
24	25°70'2	14°92'6	34'10	09'99	— .24	— .08	+ .06	23'85
25	26°04'8	15°28'8	34'04	09'62	— .06	— .08	+ .06	24'34
26	25°61'2	14°86'4	34'01	09'34	— .45	— .08	+ .06	24'20
29	25°05'7	14°25'3	33'99	10'64	+ .92	— .08	+ .06	24'25
30	25°98'9	15°20'8	34'00	10'10	— .55	— .08	+ .06	23'33
1892.								
Jan. 5	25°36'0	14°66'3	33'88	08'15	-1'12	— .08	+ .06	24'59

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP V, PAIR 6.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. "	Level. "	Ref. "	Mer. "	
1891.								
Oct. 4	16° 96' 8	22° 28' 7	21 14 20.74	+2 03.39	— .55	+ .03	+ .05	21 16 23.66
5	16° 63' 0	21° 92' 5	20.85	02.84	— .06	+ .03	+ .05	23.71
8	16° 85' 2	22° 09' 4	21.27	01.61	+ .84	+ .03	+ .05	23.80
16	16° 99' 2	22° 23' 7	22.25	01.68	— 1.06	+ .03	+ .05	22.95
28	17° 32' 5	22° 57' 1	23.50	01.70	— 2.02	+ .03	+ .05	23.26
30	16° 54' 9	21° 77' 6	23.59	01.26	— 1.53	+ .03	+ .05	23.40
31	16° 61' 3	21° 83' 8	23.64	01.21	— 1.63	+ .03	+ .05	23.30
Nov. 1	16° 55' 9	21° 73' 3	23.70	00.03	— .33	+ .03	+ .05	23.48
4	17° 19' 8	22° 39' 1	23.96	60.47	— .97	+ .03	+ .05	23.54
6	16° 83' 2	22° 00' 8	24.18	00.08	— 1.00	+ .03	+ .05	23.34
13	17° 21' 0	22° 35' 5	24.62	+1 59.36	+ .18	+ .03	+ .05	24.24
14	17° 66' 6	22° 76' 3	24.65	58.24	+ .71	+ .03	+ .05	23.68
17	17° 87' 7	23° 00' 7	24.84	59.01	— .12	+ .03	+ .05	23.81
19	17° 53' 1	22° 61' 7	25.00	57.99	+ .75	+ .03	+ .05	23.82
21	17° 68' 6	22° 84' 9	25.16	59.77	— 1.33	+ .03	+ .05	23.68
23	17° 66' 3	22° 77' 2	25.26	58.52	.00	+ .03	+ .05	23.86
30	17° 05' 8	22° 21' 0	25.32	59.52	— 1.53	+ .03	+ .05	23.39
Dec. 1	17° 53' 0	22° 55' 8	25.38	56.64	+ 1.53	+ .03	+ .05	23.63
6	17° 02' 7	22° 19' 9	25.64	59.98	— 2.10	+ .03	+ .05	23.60
9	16° 84' 2	22° 01' 7	25.65	60.05	— 1.74	+ .03	+ .05	24.04
10	16° 55' 4	21° 69' 6	25.63	59.29	— .98	+ .03	+ .05	24.02
12	16° 13' 9	21° 21' 5	25.62	57.76	+ .22	+ .03	+ .05	23.68
15	16° 52' 3	21° 62' 6	25.66	58.38	— .46	+ .03	+ .05	23.66
19	16° 94' 9	22° 02' 0	25.79	57.64	+ .17	+ .05	+ .05	23.70
21	17° 25' 8	22° 39' 8	25.78	59.24	— .95	+ .03	+ .05	24.15
23	17° 10' 9	22° 27' 1	25.70	59.75	— 1.21	+ .03	+ .05	24.32
24	17° 04' 2	22° 14' 0	25.64	58.27	— .33	+ .03	+ .05	23.66
25	16° 85' 8	22° 03' 4	25.59	60.08	— 2.00	+ .03	+ .05	23.75
26	16° 82' 6	21° 95' 7	25.50	59.03	— 1.13	+ .03	+ .05	23.48
29	16° 87' 1	21° 96' 3	25.54	58.13	— .23	+ .03	+ .05	23.52
30	16° 23' 2	21° 38' 8	25.56	59.61	— 1.16	+ .03	+ .05	24.09
1892.								
Jan. 5	16° 95' 8	22° 16' 7	25.46	60.84	— 1.86	+ .03	+ .05	24.52

GROUP V, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. "	Ref. "	Mer. "	
1891.			° ' "					° ' "
Oct. 4	13°41'0	25°77'0	21 11 37.10	+4 46.73	+ .09	+ .08	+ .05	21 16 24.05
5	13°38'7	25°74'4	37.20	46.66	+ .55	+ .08	+ .05	24.54
8	13°54'0	25°87'5	37.60	46.15	+ .38	+ .08	+ .05	24.26
16	13°42'8	25°74'6	38.55	45.76	— .72	+ .08	+ .05	23.72
30	13°74'8	26°02'2	39.84	44.74	— .05	+ .08	+ .05	24.66
31	13°65'7	25°96'8	39.88	45.60	— 1.19	+ .08	+ .05	24.42
Nov. 1	13°59'6	25°80'7	39.92	43.28	+ .51	+ .10	+ .05	23.86
4	13°45'0	25°72'2	40.17	44.69	— .49	+ .08	+ .05	24.50
6	13°81'8	26°07'9	40.40	44.44	— .37	+ .08	+ .05	24.60
14	14°09'8	26°28'0	40.86	42.60	+ .96	+ .08	+ .06	24.56
17	14°19'3	26°40'0	41.04	43.18	— .20	+ .08	+ .05	24.15
19	14°11'9	26°30'8	41.20	42.77	+ .22	+ .10	+ .05	24.34
21	14°43'1	26°57'3	41.36	41.68	+ .64	+ .08	+ .05	23.81
23	14°54'2	26°69'2	41.46	41.86	+ .71	+ .08	+ .05	24.16
30	13°73'1	25°97'9	41.54	44.14	— 1.17	+ .08	+ .06	24.65
Dec. 1	14°17'4	26°30'2	41.58	41.35	+ 1.35	+ .08	+ .05	24.41
5	13°40'6	25°62'5	41.84	43.46	— 1.47	+ .06	+ .05	23.94
9	13°31'8	25°59'7	41.90	44.86	— 1.92	+ .08	+ .05	24.97
10	13°41'0	25°63'9	41.88	43.70	— 1.46	+ .08	+ .05	24.25
12	13°59'2	25°76'6	41.87	42.42	+ .04	+ .08	+ .05	24.46
15	12°98'8	25°12'1	41.93	41.47	+ .65	+ .08	+ .05	24.18
17	13°54'5	25°73'7	42.02	42.84	— .40	+ .08	+ .05	24.59
19	13°28'2	25°47'7	42.08	42.91	— .50	+ .08	+ .05	24.62
21	13°52'9	25°72'5	42.08	42.93	— .70	+ .08	+ .05	24.44
23	13°24'6	25°41'3	42.01	42.26	+ .04	+ .08	+ .05	24.44
24	13°30'0	25°47'3	41.96	42.40	— .34	+ .12	+ .04	24.18
25	13°26'9	25°49'7	41.92	43.67	— 1.15	+ .08	+ .05	24.57
26	13°66'0	25°85'3	41.89	42.86	— .88	+ .08	+ .05	24.00
29	13°51'3	25°69'3	41.90	42.56	— .75	+ .16	+ .05	23.90
30	13°56'0	25°77'4	41.92	43.35	— .80	+ .08	+ .05	24.60
1892.								
Jan. 5	13°53'6	25°75'5	41.88	43.46	— 1.04	+ .08	+ .05	24.43

Results from observations for the variation of latitude at Waikiki, Hawaiian Islands.

GROUP V, PAIR 8.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. <i>t. d.</i>	S. <i>t. d.</i>		Mic. <i>' "</i>	Level. <i>" "</i>	Ref. <i>" "</i>	Mer. <i>" "</i>	
1891.			° ' "	' "	" "	" "	" "	° ' "
Oct. 4	19° 96' 9	17° 41' 2	21 17 23.47	—0 59.32	— '20	— '02	+ '05	21 16 23.98
5	20° 20' 4	17° 76' 6	23.56	56.56	—3.02	— '02	+ '05	24.01
8	21° 73' 6	19° 09' 7	23.95	—1 01.22	+ '73	— '02	+ '05	23.49
16	21° 89' 7	19° 32' 8	24.88	0 59.60	— '83	— '02	+ '05	24.48
30	21° 58' 7	18° 01' 9	26.14	—1 01.89	— '56	— '02	+ '05	23.72
31	21° 54' 5	18° 00' 2	26.18	01.31	—1.37	— '02	+ '05	23.53
Nov. 1	21° 75' 7	19° 02' 5	26.22	03.38	+ '81	— '02	+ '05	23.68
4	22° 18' 9	19° 51' 9	26.46	01.94	— '67	— '02	+ '05	23.88
6	22° 29' 0	19° 62' 5	26.68	01.82	— '93	— '02	+ '05	23.96
13	21° 36' 3	18° 63' 8	27.12	03.22	— '06	00	+ '04	23.88
14	22° 72' 9	19° 96' 6	27.14	04.10	+ '71	— '02	+ '05	23.78
17	22° 47' 7	19° 78' 5	27.31	02.45	— '56	— '02	+ '05	24.33
19	22° 58' 3	19° 81' 3	27.48	04.26	+ '61	— '02	+ '05	23.86
21	22° 90' 1	20° 11' 7	27.64	04.58	+ '91	— '02	+ '05	24.00
23	22° 91' 8	20° 13' 6	27.75	04.54	+1.05	— '02	+ '05	24.29
Dec. 6	21° 70' 2	19° 01' 9	28.18	—1 02.24	—1.86	— '02	+ '05	24.11
9	21° 65' 6	18° 97' 2	28.21	02.26	—1.77	— '02	+ '05	24.21
10	22° 61' 2	19° 01' 5	28.20	02.57	—1.52	— '02	+ '05	24.14
12	21° 80' 3	19° 08' 9	28.18	02.96	— '79	— '02	+ '05	24.46
15	21° 72' 1	18° 94' 3	28.25	04.44	— '12	— '02	+ '05	23.72
17	22° 44' 6	19° 69' 1	28.34	03.91	— '26	— '02	+ '05	24.20
19	22° 07' 1	19° 31' 8	28.40	03.87	— '10	00	+ '05	24.48
21	22° 00' 5	19° 23' 6	28.43	04.24	— '37	— '02	+ '05	23.85
23	22° 43' 2	19° 69' 2	28.36	03.56	— '57	— '02	+ '05	24.26
24	21° 71' 5	18° 97' 2	28.32	03.63	— '92	— '02	+ '02	23.77
25	22° 27' 4	19° 54' 1	28.28	03.40	—1.02	— '02	+ '05	23.89
26	21° 88' 5	19° 16' 1	28.25	03.19	— '73	— '02	+ '05	24.36
29	21° 50' 7	18° 87' 6	28.26	01.04	—2.95	— '02	+ '05	24.30
30	22° 17' 5	19° 45' 8	28.29	03.03	—1.28	— '02	+ '05	24.01
1892.								
Jan. 5	21° 70' 1	18° 96' 3	28.28	03.52	— '56	— '02	+ '05	24.23

GROUP VI, PAIR 1.

Date.	Micrometer.		Mean app. Dec.			Corrections.				Latitude.		
	N. t. d.	S. t. d.	°	'	"	Mic. "	Level. "	Ref. "	Mer. "	°	'	"
1891.												
Nov. 19	25°12'2	14°15'2	21	20	37'28	-4	14'49	+ .62	-.08	21	16	24'39
21	24°76'6	13°78'1			37'42		14'84	+2'76	-.08			25'32
30	24°74'8	13°88'5			37'54		12'01	- .51	-.08			25'00
Dec. 1	24°01'6	13°02'6			37'56		14'95	+2'37	-.08			24'96
5	23°99'1	13°11'3			37'79		12'35	- .54	-.08			24'88
9	24°30'4	13°44'1			37'90		12'01	- .89	-.08			24'98
10	24°51'5	13°60'6			37'89		13'07	- .14	-.08			24'66
12	24°69'1	13°74'9			37'86		13'84	+ .40	-.08			24'40
15	25°02'9	14°09'0			37'90		13'77	+ .74	-.08			24'85
19	24°77'2	13°79'7			38'08		14'60	+ .52	-.08			24'98
23	24°49'1	13°58'1			38'14		13'10	- .35	-.08			24'67
24	25°06'9	14°09'8			38'12		14'51	+1'03	-.08			24'62
25	24°18'0	13°25'5			38'09		13'44	+ .34	-.18			24'98
26	24°51'0	13°57'9			38'06		13'58	- .06	-.08			24'40
29	24°78'4	13°93'3			38'09		11'73	-1'16	-.08			25'18
30	25°28'5	14°40'8			38'12		12'33	-1'14	-.12			24'58
1892.												
Jan. 5	24°47'2	13°47'9			38'30		15'02	+1'48	-.08			24'74
6	24°96'9	13°86'0			38'28		17'71	+3'55	-.08			24'10
10	25°81'7	14°80'0			38'19		15'58	+2'16	-.08			24'75
11	24°24'6	13°30'3			38'20		13'82	+ .84	-.08			25'20
12	24°20'6	13°29'6			38'22		13'10	+ .30	-.08			25'40
15	24°46'0	13°49'6			38'32		14'35	+1'35	-.08			25'30
16	24°18'6	13°22'7			38'36		14'23	+ .32	-.08			24'43
18	23°81'5	12°82'4			38'36		14'97	+1'59	-.08			24'96
20	24°16'5	13°16'2			38'30		15'25	+1'51	-.08			24'54
21	23°93'2	12°85'9			38'26		16'88	+3'19	-.08			24'55
23	23°84'1	12°69'1			38'18		18'66	+5'31	-.08			24'81
24	24°16'9	13°22'7			38'17		13'79	+ .60	-.08			24'96
25	23°96'0	13°01'4			38'16		13'93	+1'15	-.08			25'39
27	23°87'9	12°99'2			38'21		12'56	- .20	-.08			25'43
Feb. 3	24°48'7	13°51'0			38'19		14'65	+1'52	-.08			25'04
4	24°21'6	13°22'3			38'14		15'02	+1'92	-.08			25'02
6	24°45'5	13°38'2			38'06		16'88	+3'54	-.08			24'70
8	23°95'6	12°96'9			38'04		14'88	+2'22	-.08			25'36
11	24°84'2	13°80'5			38'09		16'04	+2'88	-.08			24'91
12	24°00'6	13°02'3			38'10		14'79	+2'23	-.08			25'52
13	24°20'7	13°22'5			38'09		14'77	+1'34	-.08			24'64
14	24°31'9	13°30'0			38'08		15'62	+2'92	-.08			25'36

Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.

GROUP VI, PAIR 2.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "			
1891.										
Nov. 21	8°09.3	30°18.5	21 07 50.22	+8 32.50	+1.47	+14	+05	21 16 24.38		
30	7°89.4	30°07.1	50.30	34.47	-1.27	+14	+05	23.69		
Dec. 5	8°48.0	30°64.8	50.54	34.26	- .87	+14	+05	24.12		
9	8°43.6	30°61.9	50.63	34.61	-1.84	+14	+05	23.59		
10	8°06.4	30°19.7	50.62	33.45	- .45	+14	+05	23.81		
12	7°76.6	29°86.9	50.58	32.76	+ .07	+14	+05	23.60		
15	8°02.6	30°11.0	50.60	32.32	+ .33	+14	+05	23.44		
23	8°08.1	30°20.4	50.84	33.22	- .96	+14	+05	23.29		
26	7°61.7	29°74.3	50.74	33.29	- .42	+14	+05	23.80		
28	7°96.2	30°09.7	50.74	33.50	- .59	+14	+05	23.84		
29	7°80.9	29°96.8	50.76	34.06	-1.17	+14	+05	23.84		
1892.										
Jan. 5	7°89.2	29°96.6	50.96	32.08	+ .51	+14	+05	23.74		
6	8°24.5	30°26.2	50.94	30.76	+1.47	+14	+05	23.36		
10	8°41.3	30°47.1	50.85	31.71	+ .73	+14	+05	23.48		
11	7°33.4	29°40.5	50.86	32.01	+ .56	+14	+05	23.62		
12	7°28.5	29°43.9	50.88	33.94	-1.13	+14	+05	23.88		
15	7°13.3	29°19.1	50.99	31.71	+ .55	+16	+05	23.46		
16	6°93.5	29°04.7	51.02	32.96	- .33	+14	+05	23.84		
18	7°73.9	29°82.4	51.03	32.34	+ .36	+14	+05	23.92		
19	7°60.0	29°68.6	51.00	32.36	- .01	+14	+07	23.56		
20	7°48.5	29°59.7	50.97	32.96	- .84	+14	+05	23.28		
21	7°89.7	29°92.5	50.93	31.02	+1.95	+14	+05	24.09		
23	7°15.9	29°21.9	50.86	31.76	+1.34	+14	+05	24.15		
24	7°28.1	29°42.7	50.84	33.75	- .93	+14	+05	23.85		
27	7°73.4	29°96.3	50.89	35.68	-2.11	+14	+05	24.65		
Feb. 2	7°76.5	29°80.9	50.94	31.39	+1.51	+18	+04	24.06		
3	7°41.7	29°46.6	50.94	31.50	+1.31	+14	+05	23.94		
4	7°39.2	29°48.5	50.84	32.52	+ .57	+14	+05	24.18		
6	8°76.3	29°84.3	50.77	32.23	+ .99	+14	+05	24.18		
8	8°05.8	30°15.8	50.75	32.69	+ .63	+14	+05	24.26		
11	7°62.7	29°68.2	50.82	31.64	+1.51	+14	+05	24.16		
12	7°54.0	29°63.2	50.83	32.50	+1.16	+12	+07	24.68		
13	8°98.8	30°07.1	50.83	32.29	+ .21	+14	+05	23.52		
14	7°20.9	29°33.5	50.83	33.29	- .35	+14	+05	23.96		
20	7°29.8	29°41.8	50.53	33.15	+ .55	+14	+05	24.42		
21	6°95.9	29°08.4	50.52	33.27	- .03	+14	+05	23.95		
22	6°65.7	28°75.8	50.50	32.71	+ .62	+14	+05	24.02		
23	7°41.1	29°59.2	50.51	34.57	- .91	+14	+05	24.36		

GROUP VI, PAIR 3.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. "	Ref. "	Mer. "	
1891.			° ' "	' "	"	"	"	° ' "
Nov. 19	23°03'6	15°67'5	21 19 13'16	-2 50'76	+ '89	-05	+06	21 16 23'30
21	22°60'4	15°26'1	13'27	50'35	+ '65	-05	+06	23'58
30	22°53'7	15°26'3	13'32	48'75	-1'55	-05	+06	23'03
Dec. 1	23°60'0	16°24'8	13'32	50'55	+1'28	-05	+06	24'06
5	22°10'1	14°82'3	13'52	48'84	- '64	-05	+06	24'05
9	21°86'5	14°64'6	13'62	47'47	-1'99	-05	+06	24'17
10	21°76'0	14°53'3	13'60	47'65	-1'76	-05	+06	24'20
12	22°26'4	14°96'2	13'56	49'39	+ '23	-05	+06	24'41
15	21°68'7	14°32'6	13'57	50'76	+ '62	-05	+06	23'44
19	21°84'0	14°51'2	13'74	50'00	+ '25	-05	+06	23'99
23	21°46'8	14°14'3	13'82	49'93	+ '19	-05	+06	24'09
26	21°44'6	14°16'3	13'74	48'95	- '98	-05	+06	23'82
28	21°59'8	14°29'9	13'74	49'33	- '69	-05	+06	23'73
29	21°97'6	14°72'3	13'76	48'26	-1'49	-05	+06	24'02
30	21°67'1	14°39'3	13'79	48'84	-1'25	-05	+06	23'71
1892.								
Jan. 5	22°49'6	15°10'3	14'00	51'51	+ '82	-05	+06	23'32
6	22°37'3	15°01'7	13'99	50'65	+ '45	-05	+06	23'80
10	22°15'5	14°74'9	13'91	51'81	+1'79	-05	+06	23'00
11	21°10'1	13°74'6	13'93	50'62	+ '56	-05	+06	23'88
12	21°21'3	13°96'0	13'95	48'26	-1'10	-05	+06	24'60
15	21°20'8	13°85'4	14'08	50'60	+ '87	-05	+06	24'36
18	21°57'0	14°23'3	14'15	50'21	+ '14	-05	+06	24'09
19	21°78'5	14°44'6	14'13	50'25	- '29	-05	+06	23'60
20	21°11'2	13°85'7	14'12	48'31	-2'12	-05	+06	23'70
21	21°59'3	14°19'8	14'08	51'55	+1'02	-05	+06	23'56
23	21°21'6	13°80'2	14'02	51'99	+2'10	-05	+06	24'14
24	21°05'7	13°81'0	14'02	48'12	-1'99	-05	+06	23'92
25	20°72'4	14°47'1	14'02	48'26	-2'10	-05	+06	23'67
27	20°92'6	12°69'7	14'08	47'70	-2'02	-05	+06	24'37
Feb. 3	21°37'4	14°00'2	14'18	51'02	+ '76	-05	+06	23'93
4	21°58'0	14°21'9	14'14	50'76	+ '69	-05	+06	24'08
6	21°36'0	14°02'3	14'08	50'21	+ '24	-05	+06	24'12
8	21°23'5	13°89'1	14'08	50'37	+ '26	-05	+06	23'98
12	20°64'0	13°34'5	14'20	49'23	- '97	-05	+06	24'01
13	21°18'9	13°85'6	14'21	50'11	- '50	-05	+06	23'61
14	20°54'7	13°19'6	14'22	50'53	- '02	-05	+06	23'68
21	21°25'3	13°94'9	14'00	49'44	- '43	-05	+06	24'14
22	21°22'8	13°91'2	14'00	49'72	- '17	-05	+06	24'12
23	20°87'2	13°56'6	14'02	49'49	- '97	-05	+06	23'57

Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.

GROUP VI, PAIR 4.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. "	Level. "	Ref. "	Mer. "			
1891.			° ' "	° ' "	° ' "	° ' "	° ' "	° ' "		
Nov. 19	14° 70' 1	23° 17' 2	21 13 07.12	+3 16.51	+ .37	+ .08	+ .06	21 16 24.14		
21	15° 93' 5	24° 36' 8	07.22	15.63	+ .99	+ .05	+ .05	23.94		
Dec. 1	14° 02' 0	22° 44' 3	07.24	15.40	+ 1.12	+ .05	+ .05	23.86		
5	14° 10' 3	22° 60' 8	07.40	17.30	+ 1.23	+ .05	+ .05	23.57		
9	13° 98' 5	22° 48' 9	07.49	17.28	+ 1.33	+ .05	+ .05	23.54		
12	14° 11' 3	22° 59' 4	07.42	16.75	+ .29	+ .07	+ .05	24.00		
15	14° 85' 1	23° 30' 4	07.41	16.10	+ .44	+ .05	+ .05	24.05		
19	14° 73' 2	23° 15' 5	07.56	15.40	+ .16	+ .09	+ .05	23.26		
23	14° 02' 4	22° 49' 4	07.69	16.49	+ .28	+ .05	+ .05	24.00		
26	13° 90' 8	22° 40' 9	07.54	17.21	+ 1.09	+ .05	+ .05	23.76		
28	14° 61' 9	23° 13' 1	07.52	17.46	+ .90	+ .05	+ .05	24.18		
29	14° 55' 8	22° 08' 3	07.55	17.77	+ 1.60	+ .05	+ .05	23.82		
30	15° 30' 8	22° 81' 7	07.58	17.40	+ 1.17	+ .05	+ .05	23.91		
1892.										
Jan. 5	15° 25' 3	23° 67' 8	07.78	15.45	+ .50	+ .05	+ .05	23.83		
6	14° 94' 8	23° 36' 2	07.76	15.19	+ .35	+ .05	+ .05	23.40		
10	15° 05' 0	23° 48' 3	07.66	15.63	+ .03	+ .08	+ .05	23.45		
11	13° 93' 1	22° 39' 1	07.68	16.26	+ .12	+ .05	+ .06	24.17		
12	14° 05' 3	22° 57' 3	07.70	17.65	+ 1.08	+ .05	+ .05	24.37		
18	14° 07' 8	22° 53' 5	07.89	16.19	+ .00	+ .05	+ .05	24.18		
19	14° 20' 0	22° 66' 6	07.87	16.40	+ .51	+ .05	+ .05	23.86		
20	14° 11' 5	22° 63' 1	07.84	17.56	+ 1.35	+ .05	+ .05	24.15		
21	13° 93' 1	22° 38' 3	07.82	16.07	+ .06	+ .05	+ .05	24.05		
23	13° 84' 6	22° 24' 0	07.76	14.73	+ 1.28	+ .05	+ .05	23.87		
24	13° 79' 6	22° 30' 5	07.75	17.40	+ 1.67	+ .05	+ .05	23.58		
25	13° 46' 3	22° 96' 6	07.75	17.26	+ 1.39	+ .05	+ .05	23.72		
27	13° 51' 8	22° 08' 2	07.80	18.67	+ 2.35	+ .05	+ .05	24.22		
Feb. 3	13° 16' 8	21° 56' 2	07.90	14.73	+ .81	+ .05	+ .05	23.54		
4	13° 45' 0	21° 86' 3	07.86	15.17	+ .88	+ .05	+ .05	24.01		
6	13° 63' 6	22° 06' 9	07.79	15.63	+ .67	+ .05	+ .05	24.19		
8	14° 02' 9	22° 44' 5	07.78	15.24	+ .30	+ .05	+ .05	23.42		
11	13° 88' 2	22° 25' 2	07.88	14.17	+ 1.65	+ .05	+ .05	23.80		
12	13° 76' 5	22° 26' 2	07.90	17.12	+ 1.11	+ .05	+ .05	24.01		
13	13° 56' 5	22° 00' 3	07.92	15.75	+ .06	+ .05	+ .05	23.83		
14	12° 94' 8	21° 42' 1	07.92	16.56	+ .22	+ .05	+ .05	24.36		
20	14° 01' 3	22° 47' 6	07.72	16.33	+ .20	+ .05	+ .05	23.95		
21	13° 97' 6	22° 47' 8	07.70	17.23	+ .93	+ .05	+ .05	24.10		
22	13° 26' 6	21° 74' 4	07.70	16.68	+ .35	+ .05	+ .05	24.13		
23	13° 78' 8	22° 23' 8	07.72	16.03	+ .61	+ .05	+ .05	23.24		

GROUP VI, PAIR 5.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.								
Nov. 19	27°23'9	12°45'8	21 22 06.64	-5 42.90	+ .06	- .10	+ .06	21 16 23.76
21	27°58'2	12°78'7	06.72	43.22	+ .64	- .10	+ .06	24.10
30	25°77'6	11°10'0	06.66	40.46	-2.78	- .10	+ .06	23.38
Dec. 1	26°51'9	12°72'6	06.66	43.18	+ .12	- .10	+ .06	23.56
5	27°27'2	12°53'7	06.79	41.83	-1.72	- .10	+ .06	23.20
9	26°39'6	11°73'0	06.86	40.23	-2.90	- .10	+ .06	23.69
12	26°08'2	14°77'9	06.77	42.85	- .32	- .10	+ .06	23.56
15	25°46'7	10°72'5	06.74	41.99	- .71	- .10	+ .06	24.00
19	25°85'4	11°06'6	06.88	43.06	+ .63	- .10	+ .06	24.41
23	25°96'3	11°19'3	06.95	42.64	- .84	- .10	+ .06	23.43
25	26°08'5	11°34'4	06.89	41.97	- .58	- .10	+ .06	24.30
26	26°26'6	11°50'8	06.86	42.36	- .50	- .10	+ .06	23.96
28	26°40'6	11°68'6	06.83	41.48	- .97	- .10	+ .06	24.34
29	26°34'6	11°67'5	06.85	40.34	-2.01	- .10	+ .06	24.46
30	26°65'8	11°92'8	06.87	41.71	-1.04	- .10	+ .06	24.08
1892.								
Jan. 5	26°64'7	11°83'8	07.08	43.54	+ .23	- .10	+ .06	23.73
6	26°58'3	11°81'3	07.08	42.64	- .25	- .10	+ .06	24.15
10	26°87'9	12°08'9	06.96	43.11	- .21	- .10	+ .06	23.62
11	25°80'5	11°01'7	07.00	43.03	+ .01	- .10	+ .06	23.94
12	25°91'9	11°18'4	07.01	41.83	- .80	- .10	+ .06	24.34
18	25°18'9	10°41'1	07.23	42.82	- .17	- .10	+ .06	24.20
19	26°01'3	11°26'9	07.22	42.04	-1.46	- .10	+ .06	23.68
20	25°82'3	11°06'5	07.22	42.36	-1.01	- .10	+ .06	23.81
21	25°74'1	10°97'2	07.18	42.62	- .90	- .10	+ .06	23.62
23	25°40'9	10°56'3	07.13	44.40	+1.21	- .10	+ .06	23.90
24	25°06'2	10°31'2	07.13	42.18	-1.31	- .10	+ .06	23.60
25	25°72'0	10°99'6	07.12	41.57	-1.49	- .10	+ .06	24.02
27	25°43'4	10°79'3	07.19	39.65	-2.65	- .10	+ .06	24.85
Feb. 3	25°97'2	11°18'4	07.34	43.06	- .28	- .10	+ .06	23.96
4	25°92'0	11°12'8	07.31	43.15	.00	- .10	+ .06	24.12
6	25°61'1	10°82'5	07.26	43.01	- .11	- .10	+ .06	24.10
8	25°21'4	11°42'3	07.26	43.13	+ .06	- .10	+ .06	24.15
12	25°80'4	11°04'4	07.42	42.41	-1.39	- .10	+ .06	23.58
13	25°49'8	10°72'8	07.44	42.64	- .86	- .10	+ .06	23.90
20	25°33'5	10°55'5	07.31	42.87	- .40	- .10	+ .06	24.00
21	26°83'1	12°09'8	07.30	41.78	-1.76	- .10	+ .06	23.72
22	25°23'8	10°48'1	07.32	42.34	-1.02	- .06	+ .04	23.94
23	25°61'9	10°85'8	07.34	42.43	-1.17	- .10	+ .06	23.70

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP VI, PAIR 6.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891.								
Nov. 19	23°11'0	17°43'6	21 18 35°54	-2 11'63	+ .18	-.04	+ .05	21 16 24°10
21	23°41'2	17°70'4	35°62	12'42	+ .91	-.04	+ .05	24°12
30	22°44'7	16°72'8	35°52	12'67	+1'48	-.04	+ .05	24°34
Dec. 1	22°87'1	17°20'6	35°52	11'42	+ .44	-.04	+ .05	24°55
5	23°05'7	17°44'8	35°64	10'12	-1'37	-.04	+ .05	24°16
9	21°94'3	16°35'8	35°70	09'56	-1'99	-.04	+ .05	24°16
12	22°59'5	16°85'9	35°60	10'75	- .11	-.06	+ .05	24°73
15	22°13'4	16°48'2	35°56	11'12	- .17	-.04	+ .05	24°28
19	21°77'1	16°13'4	35°70	10'77	- .22	-.04	+ .05	24°72
23	22°28'7	16°65'1	35°76	10'75	- .52	-.04	+ .05	24°50
25	21°93'8	16°34'5	35°70	09'75	-1'38	-.04	+ .05	24°58
26	21°89'1	16°29'8	35°67	09'75	- .95	-.04	+ .05	24°98
28	22°20'6	16°56'6	35°64	10'84	- .61	-.04	+ .05	24°20
29	22°06'5	16°48'0	35°66	09'56	-1'73	-12	+ .09	24°34
30	22°96'8	16°38'1	35°67	09'61	-1'68	+ .08	+ .09	24°51
1892.								
Jan. 5	22°73'1	17°03'7	35°88	12'09	+ .22	-.04	+ .05	24°02
6	21°91'3	16°26'4	35°86	11'04	- .23	-.04	+ .05	24°60
12	22°52'1	15°92'1	35°80	09'91	-1'07	-.04	+ .05	24°83
18	21°19'9	15°56'8	36°02	10'63	- .61	-.04	+ .05	24°80
20	21°21'2	15°60'4	36°00	10'10	-1'21	-.04	+ .05	24°70
21	21°40'9	15°74'3	35°98	11'44	-0'19	-.04	+ .05	24°36
23	21°16'7	15°40'3	35°92	13'72	+2'13	-.04	+ .05	24°34
24	21°64'3	16°03'7	35°92	10'05	-1'65	-.04	+ .05	24°23
25	21°28'8	15°69'4	35°92	09'77	-1'91	-.04	+ .05	24°25
27	21°23'9	15°70'0	35°98	08'50	-2'51	-.04	+ .05	24°98
Feb. 3	21°44'5	15°75'6	36°14	11'98	+ .14	-.04	+ .05	24°31
4	21°62'1	15°94'6	36°34	11'65	+ .31	-.04	+ .05	25°01
6	20°61'9	14°94'6	36°30	11'61	+ .06	-.04	+ .05	24°76
8	22°04'8	16°34'1	36°07	12'39	+ .11	-.04	+ .05	23°80
12	21°53'3	15°92'1	36°23	10'19	-1'12	-.04	+ .05	24°93
13	21°24'8	15°60'4	36°26	10'93	- .67	-.04	+ .05	24°67
20	21°52'0	15°87'6	36°15	10'93	- .71	-.04	+ .05	24°52
21	21°59'6	15°99'2	36°14	10'00	-1'83	-.04	+ .05	24°32
22	21°12'2	15°49'8	36°16	10'47	- .75	-.06	+ .05	24°93
23	21°11'2	15°48'2	36°18	10'61	-1'01	-.04	+ .05	24°57

GROUP VI, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitu de.		
	N. t. d.	S. t. d.		Mic. ' "	Level. "	Ref. "	Mer. "	°	'	"
1891.			° ' "	' "	"	"	"	°	'	"
Nov. 19	15° 73' 0	20° 65' 5	21 14 29.60	+1 54.25	+ .11	+ .03	+ .05	21 16	24.04	
21	16° 06' 8	20° 95' 2	29.66	53.30	+ .55	+ .03	+ .05		23.59	
30	17° 05' 7	21° 04' 8	29.54	53.46	+1.22	+ .03	+ .05		24.30	
Dec. 1	17° 60' 0	22° 50' 7	29.52	53.83	+ .35	+ .03	+ .05		23.78	
5	16° 77' 5	21° 73' 7	29.62	55.11	-1.62	+ .03	+ .05		23.19	
9	16° 02' 3	21° 02' 1	29.67	55.95	-2.14	+ .03	+ .05		23.56	
12	16° 56' 4	21° 50' 4	29.56	54.60	- .22	- .01	+ .05		23.98	
15	16° 90' 9	21° 84' 7	29.50	54.55	- .28	+ .03	+ .05		23.85	
23	17° 49' 2	22° 49' 1	29.68	55.97	- .91	- .09	+ .11		24.76	
25	17° 06' 5	22° 01' 8	29.61	54.90	-1.05	- .01	+ .04		23.49	
26	16° 67' 1	21° 66' 1	29.58	55.76	-1.41	+ .03	+ .05		24.01	
28	17° 03' 5	22° 00' 6	29.54	55.32	-1.10	+ .03	+ .05		23.84	
29	17° 16' 0	22° 14' 5	29.56	55.64	-1.59	+ .03	+ .05		23.69	
30	16° 88' 0	21° 82' 2	29.57	54.65	- .39	- .01	+ .04		23.86	
1892.										
Jan. 5	16° 91' 8	21° 79' 0	29.76	53.02	+ .54	+ .03	+ .05		23.40	
6	17° 12' 5	22° 06' 9	29.74	54.69	- .43	+ .03	+ .05		24.08	
10	17° 60' 8	22° 50' 8	29.64	53.67	+ .38	+ .03	+ .05		23.77	
12	16° 55' 2	21° 49' 2	29.66	54.60	- .45	+ .03	+ .05		23.89	
18	16° 35' 6	21° 29' 0	29.88	54.46	- .45	- .01	+ .05		23.93	
19	16° 54' 4	21° 49' 6	29.88	54.88	-1.39	+ .03	+ .05		23.45	
20	16° 20' 2	21° 18' 3	29.87	55.55	-1.20	+ .03	+ .05		24.30	
21	16° 36' 3	21° 27' 9	29.84	54.04	+ .17	+ .03	+ .05		24.13	
23	16° 83' 9	21° 68' 8	29.78	52.49	+1.61	+ .03	+ .05		23.96	
24	16° 20' 6	21° 17' 7	29.78	55.32	-1.37	+ .03	+ .05		23.81	
25	16° 53' 5	21° 51' 6	29.78	55.55	-1.19	+ .03	+ .05		24.22	
27	16° 06' 3	21° 11' 0	29.84	57.08	-2.54	+ .03	+ .05		24.46	
Feb. 3	16° 75' 9	21° 65' 8	30.02	53.65	+ .27	+ .03	+ .05		24.02	
4	16° 60' 1	21° 50' 0	29.98	53.65	+ .50	+ .03	+ .05		24.21	
6	16° 01' 7	20° 90' 6	29.94	53.42	+ .30	+ .03	+ .05		23.74	
8	16° 96' 5	21° 86' 8	29.92	53.74	+ .37	+ .03	+ .05		24.11	
12	16° 50' 7	21° 48' 7	30.10	55.53	-1.17	+ .03	+ .05		24.54	
13	16° 57' 8	21° 50' 0	30.13	54.18	- .84	+ .03	+ .05		23.55	
14	16° 61' 6	21° 54' 8	30.16	54.41	- .97	+ .03	+ .05		23.68	
20	16° 63' 2	21° 60' 4	30.04	55.34	- .70	+ .11	+ .06		24.85	
22	16° 18' 8	21° 11' 5	30.05	54.30	- .45	- .01	+ .05		23.94	
23	16° 10' 8	21° 03' 7	30.08	54.35	- .65	+ .03	+ .05		23.86	

Results from observations for the variation of latitude at Waikiki, Hawaiian Islands.

GROUP VI, PAIR 8.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891.								
Nov. 19	23°11'5	14°62'2	21 19 40°28	-3 17°02	+ 88	-05	+05	21 16 24°14
21	23°71'4	15°20'3	40°32	17°44	+1°04	-05	+05	• 23°92
30	24°51'9	16°01'2	40°08	17°35	+1°82	-05	+05	24°55
Dec. 1	23°77'2	15°27'9	40°06	17°02	+1°02	-05	+05	24°06
12	23°28'0	14°84'3	40°00	15°73	+ 27	-05	+05	24°54
15	23°48'8	15°06'4	39°90	15°42	- 06	-05	+05	24°42
23	23°63'0	15°22'5	40°04	14°98	- 20	-03	+05	24°88
25	23°01'7	14°62'8	39°96	14°61	-1°09	-05	+05	24°26
26	23°57'0	15°20'7	39°92	14°01	- 88	-05	+02	25°00
28	23°33'0	14°97'9	39°86	13°73	- 98	-13	+06	25°08
29	23°94'2	15°55'7	39°88	14°52	-1°18	-05	+05	24°18
30	24°26'6	15°85'7	39°88	15°08	- 86	-05	+05	23°94
1892.								
Jan. 5	23°05'5	14°57'2	40°06	16°79	+1°31	-05	+05	24°58
6	23°67'7	15°26'1	40°04	15°24	- 42	-05	+05	24°38
10	23°88'7	15°44'0	39°92	15°96	+ 53	-13	+06	24°42
11	23°56'8	15°14'2	39°93	15°47	- 22	-03	+05	24°26
12	22°49'7	14°07'0	39°94	15°49	- 34	-05	+05	24°11
18	23°06'2	14°64'1	40°16	15°35	- 53	-05	+05	24°28
20	23°30'6	14°90'7	40°16	14°84	- 85	-05	+05	24°47
21	22°40'1	13°93'8	40°14	16°33	- 14	-05	+05	23°67
24	22°74'8	14°36'6	40°08	14°45	-1°80	-05	+05	23°83
25	22°81'6	14°42'9	40°08	14°56	-1°34	-05	+05	24°18
27	22°06'9	14°77'3	40°14	12°45	-2°55	-05	+05	25°14
Feb. 3	22°78'2	14°29'9	40°34	16°79	+ 67	-05	+05	24°22
6	22°90'3	14°46'1	40°28	15°84	- 34	-05	+05	24°10
8	22°84'0	14°39'0	40°28	16°03	+ 21	-05	+05	24°46
12	22°09'5	13°67'3	40°46	15°38	- 28	-05	+05	24°80
13	22°72'4	14°29'9	40°50	15°45	- 73	-05	+05	24°32
14	22°70'7	14°28'8	40°55	15°31	-1°05	-05	+05	24°19
20	21°76'5	14°30'4	40°48	16°28	- 04	-05	+05	24°16
21	23°35'5	14°97'7	40°48	14°36	-1°56	-05	+05	24°56
22	22°61'0	14°17'5	40°50	15°68	- 24	-05	+05	24°58
23	22°86'4	14°47'4	40°52	14°63	-1°15	-05	+05	24°74

GROUP VII, PAIR I.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. "	Level. "	Ref. "	Mer. "			
1891.			° / "	" "	" "	" "	" "	° / "		
Dec. 29	12°06'9	23°94'4	21 11 50.28	+4 35.48	— .70	+ .10	+ .04	21 16 25.20		
1892.										
Jan. 5	12°36'8	24°11'0	50.33	32.40	+1.71	+ .11	+ .06	24.61		
10	13°88'2	25°70'4	50.12	34.25	+ .73	+ .15	+ .05	25.30		
11	12°71'4	24°49'9	50.11	33.39	+1.43	+ .08	+ .05	25.06		
12	12°58'2	24°40'4	50.08	34.25	+ .47	+ .08	+ .05	24.93		
20	13°38'7	25°17'7	50.26	33.51	+ .44	+ .08	+ .05	24.34		
23	12°77'3	24°50'2	50.18	32.10	+1.94	+ .08	+ .08	24.38		
24	13°08'4	24°97'5	50.18	35.85	—1.08	+ .08	+ .06	25.09		
25	12°33'2	24°18'3	50.16	34.92	— .01	+ .11	+ .06	25.24		
27	12°64'6	24°49'3	50.20	34.83	+ .09	+ .08	+ .05	25.25		
Feb. 2	12°75'8	24°51'9	50.44	32.84	+1.77	+ .11	+ .06	25.22		
3	12°81'1	24°56'7	50.44	32.72	+1.53	+ .08	+ .05	24.82		
4	12°82'2	24°61'7	50.43	33.63	+1.06	+ .08	+ .05	25.25		
6	12°93'7	24°67'0	50.40	32.19	+1.58	+ .08	+ .05	24.30		
8	13°03'5	24°79'0	50.40	32.70	+1.27	+ .08	+ .05	24.50		
12	12°90'6	24°67'2	50.60	32.95	+ .50	+ .08	+ .05	24.18		
13	12°46'0	24°26'9	50.66	33.95	+ .10	+ .08	+ .05	24.84		
14	12°63'3	24°46'1	50.61	34.39	+ .06	+ .08	+ .06	25.20		
19	12°85'2	24°63'5	50.78	33.35	+ .48	+ .11	+ .06	24.78		
20	12°26'9	24°04'6	50.79	33.21	+ .67	+ .08	+ .06	24.81		
21	12°97'3	24°75'5	50.79	33.32	+ .59	+ .08	+ .05	24.83		
23	12°92'0	24°73'0	50.86	33.97	+ .55	+ .19	+ .08	25.65		
24	14°08'8	25°80'9	50.42	31.91	+2.46	+ .08	+ .05	24.92		
26	14°08'2	25°82'9	51.05	32.51	+1.85	+ .14	+ .03	25.58		
27	12°99'2	24°92'8	51.10	36.90	—2.98	+ .08	+ .04	25.14		
28	12°57'2	24°17'9	51.16	29.26	+4.01	+ .08	+ .05	24.56		
29	13°92'3	25°74'1	51.20	34.16	— .37	+ .08	+ .05	25.12		
Mar. 1	12°69'5	24°47'5	51.22	33.28	+ .31	+ .08	+ .05	24.94		
2	13°62'7	25°35'5	51.23	32.07	+1.55	+ .08	+ .05	24.08		
4	13°14'1	24°90'9	51.22	33.00	+ .95	+ .08	+ .05	25.30		
5	13°96'6	25°78'4	51.22	34.16	— .27	+ .08	+ .05	25.24		
9	12°56'3	24°25'6	51.36	31.26	+1.14	+ .08	+ .05	23.89		
10	12°32'4	24°12'6	51.44	33.79	+ .23	+ .08	+ .05	25.59		
13	13°47'3	25°22'0	51.62	32.51	+ .66	+ .08	+ .05	24.92		
16	12°93'4	24°68'4	51.68	32.58	+ .63	+ .08	+ .05	25.02		
19	13°50'7	25°31'8	51.66	34.00	— .31	+ .11	+ .06	25.52		
20	12°80'2	24°61'6	51.69	34.07	—1.14	+ .08	+ .05	24.75		
24	12°48'1	24°22'9	51.89	32.54	+1.02	+ .08	+ .05	25.58		
30	13°18'0	24°87'5	52.06	31.31	+1.91	+ .10	+ .04	25.42		

Results from observations for the variation of latitude at Waikiki, Hawaiian Islands.

GROUP VII, PAIR 2.

- Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. "	Level. "	Ref. "	Mer. "	
1891. Dec. 29	21°39'5	19°28'8	21 17 14.62	-0 48.88	-1.28	-01	+05	21 16 24.50
1892. Jan. 5	20°40'9	18°14'3	14.62	52.57	+1.91	-01	+05	24.00
6	20°97'6	18°76'4	14.59	51.32	+ .82	-01	+05	24.13
11	19°42'8	17°19'7	14.36	51.75	+1.28	+03	+04	23.96
12	21°41'0	19°24'5	14.34	50.22	- .08	-01	+05	24.08
18	21°05'1	18°88'8	14.50	50.18	+ .52	-01	+05	24.88
20	21°73'0	19°49'2	14.50	51.92	+1.50	-01	+05	24.12
21	22°65'9	20°46'6	14.48	50.88	+ .32	-01	+05	23.96
23	22°29'2	20°00'7	14.42	53.01	+3.15	-01	+05	24.60
24	22°57'3	20°45'6	14.38	49.11	- .84	-01	+05	24.47
25	22°32'2	20°17'9	14.38	49.72	- .21	-01	+05	24.49
27	22°54'6	20°35'8	14.42	50.76	+ .58	-01	+05	24.28
Feb. 2	22°64'7	20°38'8	14.66	52.41	+2.40	-01	+05	24.69
3	22°98'8	20°77'7	14.66	51.29	+1.54	-01	+05	24.95
4	22°40'0	20°16'9	14.66	51.76	+1.47	-03	+05	24.39
6	22°73'6	20°52'6	14.62	51.27	+1.23	-01	+05	24.62
8	22°74'3	20°51'3	14.62	51.73	+1.53	-01	+05	24.46
12	22°66'3	20°45'8	14.82	51.15	+ .85	-01	+05	24.56
13	22°46'1	20°21'4	14.88	52.13	+2.12	-01	+05	24.91
19	22°69'0	20°47'7	15.04	51.34	+ .70	-01	+05	24.44
20	22°25'5	20°71'9	15.04	50.48	+ .43	-11	+08	24.96
21	22°62'2	20°43'8	15.04	50.67	+ .75	-01	+05	25.16
23	22°12'7	19°96'2	15.10	50.22	+ .08	-01	+05	25.00
24	22°45'7	20°20'5	15.16	52.24	+1.82	-01	+05	24.78
26	22°73'7	20°51'4	15.30	51.57	- .39	-01	+05	24.16
27	22°66'6	20°54'5	15.37	49.20	-1.44	-01	+05	24.77
28	22°31'1	20°14'3	15.44	50.30	- .67	-01	+05	24.51
29	22°27'7	20°06'6	15.47	51.29	+ .18	-01	+05	24.40
Mar. 1	22°50'3	20°32'4	15.50	50.55	- .01	-01	+05	24.98
2	22°23'3	20°00'2	15.52	51.76	+ .67	-01	+05	24.47
4	22°74'6	20°57'0	15.51	50.48	- .21	-01	+05	24.86
5	22°68'5	20°51'9	15.50	50.25	- .72	-01	+05	24.57
9	22°92'0	20°70'6	15.67	51.36	+ .56	-01	+05	24.91
10	22°54'0	20°28'8	15.74	52.29	+ .76	-01	+05	24.25
13	22°48'9	20°27'6	15.96	51.34	+ .18	-01	+05	24.84
14	22°86'2	20°66'5	16.00	50.97	- .07	-01	+05	25.00
16	22°60'7	20°34'9	16.02	52.38	+1.02	-01	+05	24.70
19	22°19'5	19°98'4	16.02	51.29	- .41	-01	+05	24.36
20	22°38'5	20°22'9	16.06	50.02	-1.08	-01	+05	25.00
21	22°51'0	20°33'2	16.08	50.53	- .70	-01	+05	24.89
24	22°58'8	20°34'8	16.28	51.96	+ .17	-01	+05	24.53
29	24°05'2	21°85'2	16.48	51.04	- .53	-01	+05	24.95
30	22°35'2	20°17'4	16.48	50.53	- .89	-01	+05	25.10
31	22°65'7	20°35'9	16.48	53.31	+1.63	-01	+05	24.84

GROUP VII, PAIR 3.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1891. Dec. 29	18°44'7	18°28'0	21 16 29'12	—0 03'87	— '76	+ '02	+ '07	21 16 24'58
1892. Jan. 5	18°24'4	17°92'2	29'10	07'47	+2'08	'00	+ '07	23'78
6	18°01'8	17°74'2	29'07	06'40	+1'36	'00	+ '07	24'10
11	17°77'9	17°54'2	28'83	05'50	+ '88	'00	+ '07	24'28
12	17°80'2	17°57'5	28'80	05'27	+ '88	+ '04	+ '07	24'52
18	17°61'1	17°40'4	28'94	04'80	+ '17	'00	+ '07	24'38
20	17°66'2	17°38'2	28'95	06'50	+1'91	'00	+ '07	24'43
21	18°16'8	18°12'2	28'92	01'07	—3'40	'00	+ '07	24'52
23	17°28'9	16°99'7	28'86	06'77	+2'82	'00	+ '07	24'98
24	17°73'5	17°57'3	28'84	03'76	— '58	'00	+ '07	24'57
25	17°32'6	17°16'0	28'82	03'85	— '50	'00	+ '07	24'54
27	17°38'6	17°16'8	28'85	05'06	+ '23	'00	+ '07	24'09
Feb. 2	17°72'9	17°44'6	29'08	06'57	+1'71	'00	+ '07	24'29
3	17°45'4	17°22'2	29'07	05'38	+ '84	'00	+ '07	24'60
4	17°88'0	17°63'1	29'06	05'78	+1'13	'00	+ '07	24'48
6	17°69'2	17°44'8	29'03	05'66	+ '88	'00	+ '07	24'32
8	17°99'5	17°77'8	29'02	05'03	+ '58	'00	+ '07	24'64
12	17°30'5	17°10'4	29'21	04'66	+ '14	'00	+ '07	24'76
13	18°08'0	17°83'0	29'28	05'80	+ '65	+ '08	+ '10	24'31
19	18°29'6	18°04'0	29'42	05'94	+1'02	'00	+ '07	24'57
20	17°83'5	17°59'3	29'41	05'61	+0'55	'00	+ '07	24'42
24	16°92'1	16°67'8	29'53	05'64	+ '67	'00	+ '07	24'63
26	17°82'9	17°60'5	29'67	05'20	+ '33	'00	+ '07	24'87
27	17°60'8	17°47'1	29'73	03'18	—1'91	'00	+ '07	24'71
28	17°95'8	17°56'6	29'80	09'09	+3'84	'00	+ '07	24'62
29	18°40'2	18°24'1	29'83	03'74	—1'46	'00	+ '07	24'70
Mar. 1	17°62'5	17°38'6	29'86	05'54	+ '24	'00	+ '07	24'63
2	18°05'5	17°84'6	29'87	04'85	— '21	'00	+ '07	24'88
4	17°61'7	17°45'7	29'86	03'71	—1'30	'00	+ '07	24'92
5	17°80'5	17°64'8	29'86	03'64	—1'20	'00	+ '07	25'09
9	17°71'7	17°46'6	30'00	05'82	+ '41	'00	+ '07	24'66
10	17°99'7	17°76'7	30'08	05'34	— '09	'00	+ '07	24'72
13	17°51'3	17°23'8	30'29	06'38	+ '27	'00	+ '07	24'24
14	17°95'1	17°75'6	30'32	04'52	—1'39	'00	+ '07	24'48
16	17°99'6	17°78'4	30'36	04'92	— '55	— '04	+ '05	24'90
19	17°79'9	17°60'3	30'36	04'55	—1'19	'00	'00	24'62
20	18°13'0	17°96'9	30'39	03'74	—2'22	'00	+ '07	24'50
21	18°02'9	17°84'5	30'41	04'27	—1'54	+ '04	+ '05	24'69
24	16°94'1	16°73'0	30'58	04'90	—1'02	'00	+ '07	24'73
29	17°76'0	17°55'8	30'79	04'69	—1'17	+ '02	+ '07	25'02
30	18°18'2	18°01'5	30'74	03'87	—1'85	'00	+ '07	25'09
31	18°30'9	18°03'9	30'78	06'26	+ '47	'00	+ '07	25'06

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP VII, PAIR 4.

Date.	Micrometer.		Mean app. Dec.			Corrections.				Latitude.		
	<i>N.</i> <i>t. d.</i>	<i>S.</i> <i>t. d.</i>	°	'	"	<i>Mic.</i> "	<i>Level.</i> "	<i>Ref.</i> "	<i>Mer.</i> "	°	'	"
1891. Dec. 29	22°37'0	17°39'8	21	18	20'80	—1 55'34	— '90	—'03	+'01	21	16	24'58
1892. Jan. 5	22°67'9	17°55'4			20'72	1 58'89	+1'82	—'03	+'05			23'67
6	22°71'5	17°60'9			20'68	58'45	+1'05	—'03	+'05			23'30
11	21°51'2	16°42'5			20'42	58'01	+1'19	—'03	+'05			23'62
12	21°34'2	16°28'9			20'39	57'22	+ '58	—'01	+'04			23'80
20	19°86'9	14°75'5			20'50	58'64	+1'42	—'03	+'05			23'30
21	21°32'4	16°22'1			20'48	58'38	+1'66	—'03	+'05			23'78
23	21°60'6	16°57'8			20'41	56'64	— '10	—'03	+'05			23'69
24	22°02'6	17°03'0			20'38	55'90	— '40	—'03	+'05			24'10
25	21°32'8	16°34'7			20'36	55'55	— '47	—'07	+'05			24'32
27	22°10'7	17°07'7			20'38	56'69	+ '62	—'03	+'05			24'33
Feb. 2	21°74'3	16°67'3			20'62	57'62	+ '50	—'03	+'05			24'52
3	21°95'7	16°88'8			20'61	57'59	+1'06	—'03	+'05			24'10
4	21°69'3	16°63'7			20'60	57'29	+ '64	—'03	+'05			23'97
6	21°43'7	16°38'5			20'56	57'20	+ '61	—'03	+'05			23'99
8	21°88'2	16°83'8			20'56	57'01	+1'00	—'03	+'05			24'57
12	21°50'9	16°50'3			20'74	56'13	+ '01	—'03	+'05			24'64
13	21°57'2	16°52'2			20'82	57'15	+ '42	—'03	+'05			24'11
19	21°49'0	16°44'1			20'98	57'13	+ '31	—'03	+'05			24'18
20	21°44'2	16°40'1			20'48	56'94	+ '16	—'03	+'05			23'72
21	22°03'0	17°00'5			20'99	56'57	+ '26	—'03	+'05			24'70
23	22°07'4	17°05'0			21'05	56'55	+ '26	—'03	+'05			24'78
24	20°90'1	15°89'2			21'11	56'20	— '11	—'03	+'05			24'82
26	21°94'1	16°92'1			21'26	56'46	— '40	—'03	+'05			24'42
27	21°72'4	16°79'5			21'25	54'35	—2'08	—'03	+'05			24'84
28	21°37'7	16°41'2			21'39	55'18	—1'65	—'03	+'05			24'58
29	22°28'0	17°26'4			21'43	56'36	— '69	—'03	+'05			24'40
Mar. 1	21°44'0	16°40'7			21'48	56'76	— '11	—'03	+'05			24'63
2	21°19'8	16°14'1			21'49	57'31	+ '08	—'03	+'05			24'28
4	21°47'7	16°46'0			21'50	56'39	— '46	—'03	+'05			24'67
5	21°86'4	16°85'5			21'50	56'20	— '56	—'03	+'05			24'76
9	21°05'1	15°96'1			21'66	58'08	+ '43	—'03	+'05			24'03
10	22°06'4	17°01'8			21'74	57'06	— '14	—'03	+'05			24'56
13	21°88'2	16°78'5			21'98	58'24	+ '59	—'11	+'08			24'30
14	21°79'5	16°72'0			22'03	57'73	+ '23	—'03	+'05			24'55
16	21°52'5	16°45'5			22'08	57'62	+ '27	—'03	+'05			24'75
21	21°89'8	16°87'7			22'16	56'48	— '87	—'03	+'05			24'83
24	21°64'8	16°58'1			22'36	57'55	— '19	—'03	+'05			24'64
29	21°86'4	16°76'2			22'62	58'36	—1'02	—'03	+'05			23'26
31	21°79'5	16°66'9			22'62	58'92	+ '74	—'03	+'05			24'46

GROUP VII, PAIR 5.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	<i>N.</i> <i>t. d.</i>	<i>S.</i> <i>t. d.</i>	<i>° ' "</i>	<i>Mic.</i> <i>' "</i>	<i>Level.</i> <i>" "</i>	<i>Ref.</i> <i>" "</i>	<i>Mer.</i> <i>" "</i>	<i>° ' "</i>		
1891. Dec. 29	16° 71' 1	22° 10' 6	21 14 20·60	+ 2 05·16	- 1·71	+·04	+·06	21 16 24·15		
1892. Jan. 5	16° 30·4	21° 52·8	20·46	01·19	+ 1·05	+·04	+·06	22·80		
6	16° 54·5	21° 82·6	20·43	02·51	+·25	+·04	+·06	23·29		
11	16° 40·1	21° 72·0	20·14	03·39	-·19	+·04	+·06	23·44		
12	15° 93·6	21° 24·4	20·10	03·14	-·10	+·04	+·06	23·24		
20	16° 24·7	21° 51·7	20·18	02·26	+·86	+·04	+·06	23·40		
21	16° 20·7	21° 48·4	20·16	02·42	+ 1·19	+·04	+·06	23·87		
23	15° 42·0	20° 78·0	20·08	04·34	-·69	+·04	+·06	23·83		
24	16° 48·7	21° 90·3	20·06	05·64	- 2·24	+·04	+·06	23·56		
25	15° 26·7	20° 65·9	20·03	05·09	- 1·80	+·04	+·06	23·42		
27	16° 45·2	21° 80·0	20·04	04·07	-·28	+·04	+·06	23·93		
Feb. 2	16° 30·1	21° 60·2	20·25	02·98	+·45	+·04	+·06	23·78		
3	15° 68·0	20° 98·2	20·24	03·00	+·34	+·04	+·06	23·68		
4	15° 94·7	21° 28·0	20·24	03·72	-·21	+·04	+·06	23·85		
8	15° 33·0	21° 63·8	20·18	03·14	+·10	+·04	+·06	23·52		
12	16° 46·5	21° 79·8	20·36	03·72	-·85	+·04	+·06	23·33		
13	16° 45·8	21° 78·5	20·44	03·58	-·32	+·04	+·06	23·80		
19	15° 91·5	21° 23·2	20·61	03·35	-·67	+·14	+·14	23·57		
21	16° 65·0	21° 99·8	20·62	04·07	- 1·02	+·04	+·06	23·77		
23	15° 22·2	20° 58·3	20·68	04·37	- 1·25	+·04	+·06	23·90		
24	16° 23·2	21° 58·0	20·73	04·07	- 0·80	+·04	+·06	24·10		
26	15° 69·8	21° 04·0	20·88	03·93	-·99	+·04	+·06	23·92		
27	16° 27·0	21° 70·1	20·94	05·99	- 3·27	+·04	+·06	23·76		
28	15° 50·3	20° 93·2	21·02	05·94	- 3·22	+·04	+·06	23·84		
29	16° 00·3	21° 20·2	21·06	00·61	+ 1·76	+·04	+·06	23·53		
Mar. 1	16° 56·3	21° 91·7	21·10	04·20	- 1·40	+·04	+·06	24·00		
2	16° 22·2	21° 56·0	21·12	03·83	- 1·21	+·04	+·06	23·84		
4	15° 55·2	20° 94·2	21·13	05·04	- 2·20	+·04	+·06	24·07		
5	15° 74·4	21° 14·7	21·13	05·34	- 2·35	+·04	+·06	24·22		
9	16° 76·6	22° 06·4	21·30	02·91	-·70	+·04	+·06	23·61		
10	16° 12·5	21° 42·9	21·38	03·04	-·69	+·04	+·06	23·83		
13	16° 16·3	21° 50·7	21·62	03·97	- 1·12	+·09	+·06	24·62		
14	16° 36·6	21° 67·7	21·68	03·21	- 1·13	+·04	+·06	23·86		
16	15° 85·7	21° 17·1	21·74	03·28	- 1·22	+·04	+·06	23·90		
19	16° 41·5	21° 77·5	21·76	04·34	- 2·33	+·04	+·06	23·87		
20	15° 81·4	21° 19·0	21·80	04·72	- 2·44	+·04	+·06	24·18		
21	16° 18·0	21° 54·2	21·82	04·39	- 1·87	+·04	+·06	24·44		
24	15° 43·0	20° 76·6	22·02	03·79	- 1·63	+·04	+·06	24·28		
30	16° 08·5	21° 49·3	22·31	05·46	- 3·35	+·04	+·10	24·48		
31	15° 71·3	20° 94·3	22·32	01·33	-·23	+·04	+·06	23·52		

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP VII, PAIR 6.

Date.	Micrometer.		Mean app. Dec.			Corrections.				Latitude.		
	N. t. d.	S. t. d.	°	'	"	Mic. "	Level. "	Ref. "	Mer. "	°	'	"
1891. Dec. 29	21°07'3	18°48'7	21	17	26.23	—0 59'99	—1'37	—'02	+ '07	21	16	24.92
1892. Jan. 5	21°09'4	18°41'7			26.00	—1 02'10	+ '71	—'02	+ '07			24.66
6	21°02'4	18°31'6			25.95	02'82	+1'00	—'02	+ '07			24.18
11	20°03'9	17°43'7			25.60	00'36	— '71	—'02	+ '07			24.58
18	19°76'5	17°14'6			25.56	00'76	— '13	—'02	+ '07			24.72
20	19°92'8	17°25'6			25.54	01'99	+1'08	—'02	+ '07			24.68
21	20°23'0	17°54'2			25.52	02'36	+1'49	—'02	+ '07			24.70
23	20°13'7	17°55'6			25.44	—0 59'88	—1'09	—'02	+ '08			24.53
24	29°59'6	17°06'7			25.40	58'67	—2'06	—'02	+ '07			24.72
27	21°64'0	19°05'8			25.34	59'90	— '69	—'02	+ '07			24.80
Feb. 2	22°22'6	19°58'2			25.52	—1 01'34	+ '59	—'02	+ '07			24.82
3	23°86'2	21°25'6			25.52	00'46	— '31	—'02	+ '07			24.80
4	23°94'7	21°31'3			25.01	01'10	+ '60	—'02	+ '07			24.56
6	23°96'8	21°36'6			25.46	00'36	— '23	—'02	+ '07			24.92
8	24°26'0	21°68'5			25.44	—0 59'74	— '58	—'02	+ '07			25.17
12	23°47'6	20°92'1			25.60	59'27	—1'59	—'02	+ '07			24.79
13	23°61'3	21°04'7			25.67	59'53	—1'19	—'02	+ '07			25.00
20	23°51'7	20°92'5			25.87	—1 00'13	— '73	—'02	+ '07			25.06
21	23°78'3	21°20'8			25.88	—1 59'74	—1'27	—'02	+ '07			24.92
23	23°55'6	20°96'1			25.93	—1 00'20	— '68	—'02	+ '07			25.10
24	23°45'6	20°91'4			25.98	—0 58'97	—1'94	—'02	+ '07			25.12
27	24°02'6	21°39'1			26.21	—1 01'13	— '43	—'02	+ '07			24.70
28	23°74'5	21°14'4			26.32	—1 00'34	— '96	—'02	+ '07			25.07
29	24°29'3	21°74'1			26.35	—0 59'20	—2'22	—'02	+ '07			24.98
Mar. 1	23°86'7	21°32'0			26.38	—0 59'09	—1'98	—'02	+ '07			25.36
2	23°85'0	21°29'5			26.40	59'27	—1'81	—'02	+ '07			25.37
4	23°79'4	21°23'2			26.43	59'43	—1'45	—'02	+ '07			25.60
5	23°90'2	21°33'5			26.44	59'55	—1'54	—'02	+ '07			25.40
9	23°94'7	21°30'7			26.62	—1 01'24	— '34	—'02	+ '07			25.09
10	23°64'0	21°01'9			26.70	00'80	— '99	—'02	+ '07			24.96
13	24°26'1	21°64'4			26.97	00'71	— '88	—'02	+ '00			25.36
14	23°95'6	21°31'8			27.04	01'20	— '61	—'02	+ '07			25.28
16	24°06'2	21°46'9			27.12	00'15	—1'62	—'02	+ '07			25.40
19	23°77'2	21°18'8			27.18	—0 59'94	—1'83	+ '02	+ '05			25.48
20	23°86'3	21°29'6			27.22	59'55	—2'54	—'02	+ '05			25.16
21	24°31'4	21°73'1			27.26	59'92	—2'04	—'02	+ '07			25.35
24	23°75'1	21°14'4			27.48	—1 00'48	—1'69	—'00	+ '07			25.38
29	23°44'3	20°83'9			27.81	00'41	—2'13	—'02	+ '07			25.32
31	23°09'2	21°39'3			27.86	02'61	— '02	—'02	+ '07			25.28

GROUP VII, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. "	Level. "	Ref. "	Mer. "			
1891. Dec. 29	24°55'9"	14°42'5"	21 20 29'27"	-4 04'37"	- '60	- '07	+ '05	21 16	24°28'	
1892 Jan. 5	24°65'6"	14°00'6"	28°94'	07°06'	+1°82'	- '07	+ '05		23°68'	
6	24°74'6"	14°08'5"	28°90'	07°32'	+1°89'	- '07	+ '05		23°45'	
11	23°67'0"	13°08'7"	28°48'	05°51'	+1°51'	- '07	+ '05		24°46'	
20	24°09'5"	13°48'2"	28°38'	06°21'	+2°07'	- '07	+ '05		24°22'	
24	23°73'7"	13°24'9"	28°18'	03°31'	+ '28	- '07	+ '05		24°57'	
25	23°80'8"	13°27'0"	28°16'	04°47'	+ '27	- '07	+ '05		23°94'	
Feb. 2	23°44'0"	12°85'8"	28°30'	05°49'	+2°15'	- '07	+ '05		24°94'	
3	24°33'8"	13°77'1"	28°29'	05°14'	+1°61'	- '07	+ '05		24°74'	
4	23°96'3"	13°37'6"	28°28'	05°60'	+1°74'	- '07	+ '05		24°40'	
8	24°35'4"	13°78'2"	28°20'	05°25'	+1°19'	- '07	+ '05		24°12'	
12	24°03'6"	13°48'8"	28°35'	04°70'	+ '73	- '07	+ '05		24°36'	
13	24°15'2"	13°61'0"	28°42'	04°56'	+ '47	- '07	+ '05		24°31'	
19	23°88'9"	13°30'3"	28°64'	05°58'	+1°24'	- '10	+ '06		24°26'	
20	23°82'4"	13°27'7"	28°64'	04°67'	+ '25	- '07	+ '05		24°20'	
23	23°52'9"	13°02'7"	28°70'	03°63'	- '15	- '07	+ '05		24°90'	
24	23°46'7"	12°96'4"	28°76'	03°65'	- '19	- '07	+ '05		24°90'	
27	23°86'6"	13°23'4"	28°98'	06°65'	+2°41'	- '07	+ '05		24°72'	
28	24°02'2"	13°47'4"	29°06'	04°70'	+ '39	- '07	+ '05		24°73'	
29	23°81'2"	13°28'0"	29°12'	04°33'	- '24	- '07	+ '05		24°53'	
Mar. 1	23°66'3"	13°12'3"	29°18'	04°51'	- '10	- '07	+ '05		24°55'	
2	24°02'0"	13°49'1"	29°22'	04°26'	- '49	- '07	+ '05		24°45'	
4	24°02'2"	13°53'3"	29°25'	03°33'	-1°28'	- '07	+ '05		24°62'	
5	24°04'4"	13°54'7"	29°26'	03°51'	- '97	- '07	+ '05		24°76'	
9	23°94'1"	13°39'4"	29°45'	04°67'	- '32	- '07	+ '05		24°44'	
10	24°08'1"	13°54'5"	29°54'	04°42'	- '16	- '07	+ '05		24°94'	
13	24°07'4"	13°47'9"	29°83'	05°79'	+ '17	- '03	+ '04		24°22'	
14	24°02'7"	13°47'3"	29°91'	04°84'	- '32	- '07	+ '05		24°73'	
16	24°20'7"	13°63'1"	30°02'	05°35'	- '21	- '07	+ '05		24°44'	
20	23°87'3"	13°35'0"	30°14'	04°12'	-1°39'	+ '04	+ '08		24°75'	
21	23°83'2"	13°30'3"	30°18'	04°26'	-1°12'	- '11	+ '04		24°73'	
24	24°09'1"	13°52'9"	30°42'	05°02'	- '25	- '07	+ '05		25°13'	
29	24°44'1"	13°91'1"	30°80'	04°28'	-1°47'	- '07	+ '05		25°03'	
31	23°82'5"	13°20'9"	30°87'	06°28'	+ '67	- '07	+ '05		25°24'	

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP VII, PAIR 8.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1891. Dec. 29	17·21·9	20·46·2	21 15 13·18	+1 15·23	—3·91	+·04	+·04	21 16 24·58
1892. Jan. 5	19·17·2	22·12·4	12·80	08·48	+2·14	+·02	+·05	23·49
6	19·44·6	22·40·4	12·74	08·62	+2·18	+·02	+·05	23·61
11	18·82·1	21·89·1	12·30	11·22	+·89	+·02	+·05	24·48
18	18·35·4	21·46·6	12·14	12·19	+·48	+·02	+·05	24·88
20	18·45·1	21·46·6	12·11	09·94	+1·75	+·02	+·05	23·87
23	18·07·7	21·17·3	11·98	11·82	+·21	+·02	+·05	24·08
24	18·34·7	21·47·3	11·92	12·52	—·38	+·02	+·05	24·13
25	18·16·1	21·29·8	11·87	12·77	+·04	+·02	+·05	24·75
Feb. 2	18·19·6	21·20·3	11·95	09·76	+2·49	+·02	+·05	24·27
3	17·90·8	20·96·2	11·94	10·85	+1·70	+·02	+·05	24·56
4	18·45·6	21·52·6	11·94	11·22	+1·23	+·02	+·05	24·46
8	18·34·6	21·41·4	11·84	11·17	+1·31	+·02	+·05	24·39
12	18·11·7	21·20·3	11·98	11·59	+·44	+·02	+·05	24·08
13	18·99·4	22·07·4	12·04	11·45	+·51	+·02	+·05	24·07
20	18·80·6	21·88·0	12·28	11·31	+·60	+·02	+·05	24·26
23	18·62·1	21·71·2	12·33	11·71	+·63	+·02	+·05	24·74
24	18·25·2	21·32·7	12·38	11·34	+·78	+·02	+·05	24·57
27	18·55·9	21·56·0	12·61	09·62	+2·30	+·02	+·05	24·60
28	17·97·4	21·04·1	12·69	11·15	+·52	+·02	+·05	24·43
29	18·15·3	21·27·3	12·75	12·38	—·36	+·02	+·05	24·84
Mar. 1	18·42·6	21·50·0	12·82	11·31	+·33	+·02	+·05	24·53
2	18·49·1	21·58·9	12·85	11·87	—·33	+·02	+·05	24·46
5	17·62·6	20·76·3	12·90	12·77	—·90	+·02	+·05	24·84
9	18·33·9	21·41·5	13·10	11·36	—·26	+·02	+·04	24·22
10	17·99·0	21·06·1	13·20	11·24	+·26	+·02	+·05	24·77
13	18·33·3	21·36·8	13·60	10·41	+·32	+·02	+·05	24·40
14	17·92·2	20·99·8	13·75	11·36	—·12	+·02	+·05	25·06
16	18·11·2	21·16·3	13·70	10·78	+·02	+·02	+·05	24·57
21	18·55·6	21·65·6	13·90	11·92	—1·11	+·02	+·05	24·78
24	18·22·9	21·27·4	14·14	10·64	—·37	+·02	+·05	24·48
29	18·27·0	21·33·7	14·56	11·15	—1·08	+·02	+·05	24·70
31	18·53·8	21·50·6	14·64	08·85	+·85	—·06	+·07	24·35

GROUP VIII, PAIR 1.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "			
1892.			° ' "					° ' "		
Feb. 3	23°34'0	24°64'3	21 15 52.92	+0 30.23	+ .65	+ .01	+ .05	21 16 23.86		
8	23°30'5	25°18'2	52.74	31.94	— .80	+ .01	+ .05	23.94		
12	23°37'9	25°25'4	52.77	31.90	— .74	+ .01	+ .05	23.99		
21	24°77'6	26°17'5	53.04	32.45	— .47	+ .01	+ .05	25.08		
23	23°70'7	25°09'7	53.07	32.25	— 1.16	+ .01	+ .05	24.22		
27	23°36'7	25°25'8	53.30	29.95	+ .81	+ .01	+ .05	24.12		
28	23°76'8	25°16'7	53.38	32.45	— 1.27	+ .01	+ .05	24.62		
29	23°49'1	24°30'4	53.46	32.78	— 2.03	+ .01	+ .05	24.27		
Mar. 2	23°37'6	25°36'7	53.57	32.27	— .98	+ .01	+ .05	24.92		
5	22°39'7	24°45'3	53.64	33.78	— 2.58	+ .01	+ .05	24.90		
8	22°37'2	24°20'0	53.75	30.81	— .11	+ .01	+ .07	24.53		
9	23°37'9	25°34'4	53.84	31.67	— .85	+ .01	+ .05	24.72		
10	23°45'8	24°30'1	53.92	31.16	— .82	+ .01	+ .05	24.32		
13	23°53'4	24°31'6	54.24	32.06	— 1.63	+ .04	+ .06	24.77		
14	23°68'7	25°05'0	54.35	31.62	— 1.45	+ .01	+ .05	24.58		
16	23°59'0	24°32'8	54.50	31.04	— 1.57	+ .04	+ .06	24.07		
21	23°58'2	24°34'6	54.76	31.64	— 1.70	+ .01	+ .05	24.76		
23	23°56'1	24°31'5	54.91	31.41	— 1.68	+ .01	+ .07	24.72		
24	23°41'2	24°74'9	55.01	31.02	— 1.38	+ .01	+ .05	24.71		
29	24°16'2	25°52'3	55.54	31.57	— 2.11	— .07	+ .07	25.00		
30	23°77'8	25°15'4	55.60	31.92	— 2.79	+ .01	+ .05	24.79		
31	23°66'5	24°34'5	55.66	29.69	— .65	+ .01	+ .05	24.76		
Apr. 6	24°39'2	25°65'3	56.04	29.25	— .90	+ .03	+ .06	24.48		
9	24°04'5	25°29'8	56.42	29.07	— .17	+ .01	+ .05	25.38		
10	24°27'7	25°55'3	56.54	29.60	— 1.06	+ .01	+ .05	25.14		
15	23°79'0	25°04'8	56.92	29.18	— 2.16	— .07	+ .07	23.94		
16	24°60'4	25°30'1	56.97	27.77	— .42	+ .01	+ .05	24.38		
17	24°37'1	25°44'7	57.02	24.96	+ 2.27	— .03	+ .04	24.26		
19	24°68'3	25°38'2	57.18	27.81	— .62	+ .01	+ .05	24.43		
20	24°69'7	25°31'1	57.28	28.16	— 1.12	+ .01	+ .05	24.38		
21	25°08'9	26°31'7	57.38	28.49	— .97	+ .01	+ .05	24.96		
23	23°31'6	25°00'8	57.60	27.65	— .72	+ .01	+ .05	24.59		
24	23°75'4	24°30'9	57.70	26.79	+ .17	+ .01	+ .05	24.72		
25	24°16'7	25°38'0	57.80	28.14	— 1.57	+ .01	+ .05	24.43		
29	24°34'0	25°47'3	57.98	26.28	+ .04	+ .01	+ .05	24.36		
May 2	24°60'9	25°31'0	58.13	27.86	— 1.20	+ .01	+ .05	24.85		
4	24°63'4	25°36'6	58.31	28.58	— 2.49	+ .01	+ .05	24.46		
5	24°79'5	25°38'0	58.42	27.49	— 1.63	+ .01	+ .05	24.34		
6	23°48'0	24°58'9	58.53	25.73	+ .24	+ .01	+ .05	24.56		
9	24°60'8	25°71'9	58.80	25.77	.00	+ .01	+ .05	24.63		
10	24°77'7	25°39'7	58.86	25.98	— .40	+ .01	+ .05	24.50		
11	25°20'7	26°35'1	58.90	26.54	— .31	+ .01	+ .07	25.21		
15	24°48'0	25°65'2	59.03	27.19	— .40	+ .01	+ .01	25.84		

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP VIII, PAIR 2.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.	° ' "	Mic. ' "	Level. "	Ref. "	Mer. "	° ' "
1892.								
Feb. 3	7°10'3	28°86'5	21 07 58.23	+8 24.84	+ .91	+ .15	+ .05	21 16 24.18
8	7°10'2	28°93'7	58.02	26.54	+ .13	+ .15	+ .05	24.89
12	6°92'7	28°80'0	58.03	27.42	-1.47	+ .15	+ .05	24.18
21	7°09'2	28°92'9	58.26	26.58	- .49	+ .19	+ .04	24.58
23	6°81'8	28°65'7	58.28	26.63	- .76	+ .15	+ .05	24.35
27	7°17'2	28°94'6	58.50	25.12	+ .50	+ .15	+ .05	24.32
28	7°11'3	28°96'4	58.57	26.91	- .92	+ .15	+ .05	24.76
29	7°24'1	29°15'1	58.65	28.28	-1.99	+ .15	+ .05	25.14
Mar. 2	7°14'2	29°01'8	58.76	27.49	-1.66	+ .15	+ .05	24.79
5	7°18'5	29°10'1	58.83	28.42	-2.65	+ .15	+ .05	24.80
8	6°94'9	28°79'1	58.94	26.70	-1.04	+ .15	+ .05	24.80
9	6°72'2	28°53'5	59.02	26.03	- .67	+ .15	+ .05	24.58
10	7°09'7	28°94'7	59.09	26.89	-1.50	+ .15	+ .05	24.68
13	7°09'0	28°47'2	59.42	25.31	- .74	+ .04	+ .08	24.11
14	7°05'5	29°47'2	59.52	26.12	-1.16	+ .15	+ .05	24.68
23	6°81'2	28°58'6	00.10	25.12	-1.36	+ .15	+ .05	24.06
24	6°94'5	28°76'4	00.20	26.17	-1.71	+ .15	+ .05	24.86
29	7°00'1	28°71'6	00.74	23.75	- .11	+ .15	+ .05	24.58
30	7°00'6	28°71'3	00.80	23.57	- .11	+ .15	+ .05	24.46
31	7°39'5	29°11'7	00.87	23.92	- .33	+ .15	+ .05	24.66
Apr. 6	8°50'9	29°23'7	01.28	24.06	- .78	+ .15	+ .07	24.78
9	7°23'1	28°97'2	01.66	24.36	-1.43	+ .15	+ .05	24.79
14	7°11'8	28°84'9	02.14	24.12	-1.68	+ .15	+ .05	24.78
17	7°03'1	28°77'4	02.32	24.40	-2.48	+ .15	+ .05	24.44
19	7°61'8	29°31'7	02.48	23.38	-1.15	+ .15	+ .05	24.91
23	7°40'0	29°05'8	02.92	22.43	-1.00	+ .15	+ .05	24.55
24	7°27'7	28°91'8	03.02	22.04	- .78	+ .15	+ .05	24.48
25	7°29'7	28°97'6	03.12	22.92	-1.38	+ .15	+ .05	24.86
29	7°32'9	28°96'3	03.34	21.88	- .88	+ .15	+ .05	24.54
May 2	7°50'6	29°12'4	03.50	21.50	- .18	+ .15	+ .05	25.02
4	7°48'1	29°20'0	03.70	23.85	-3.37	+ .15	+ .05	24.38
5	7°28'2	28°93'0	03.80	22.20	-1.64	+ .15	+ .05	24.56
6	7°67'0	29°27'1	03.92	21.11	- .45	+ .15	+ .05	24.78
9	7°12'9	28°71'0	04.22	20.65	- .20	+ .15	+ .05	24.87
10	7°53'6	29°11'3	04.28	20.55	- .46	+ .15	+ .05	24.57
11	7°25'8	28°80'9	04.34	19.95	+ .04	+ .15	+ .05	24.53
14	7°53'2	29°13'2	04.46	21.09	- .73	+ .15	+ .05	25.02
15	7°40'8	28°96'2	04.50	20.02	- .22	+ .15	+ .05	24.50
18	7°55'2	29°09'5	04.70	19.77	+ .17	+ .15	+ .05	24.84

GROUP VIII, PAIR 3.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "			
1892.										
Feb. 3	20°54'9	14°97'5	21 18 33'06	-2 09'31	+1'19	-04	+05	21 16 24'95		
12	21°64'4	16°14'2	32'82	07'64	-19	-04	+05	25'00		
21	21°70'4	16°19'7	33'04	07'75	00	-04	+05	25'30		
23	21°67'7	16°15'3	33'04	08'15	-13	-04	+05	24'77		
27	21°64'1	16°04'2	33'24	09'89	+1'50	-04	+05	24'86		
28	22°25'4	16°75'5	33'32	07'57	-47	-04	+05	25'29		
29	22°26'7	16°83'0	33'39	06'13	-1'73	00	+06	25'59		
Mar. 2	21°42'2	15°90'7	33'50	07'94	-60	-04	+05	24'97		
5	21°55'4	16°09'8	33'57	06'57	-1'44	-04	+05	25'57		
8	21°62'5	16°10'1	33'66	08'15	-16	-04	+05	25'36		
9	21°76'9	16°23'2	33'74	08'45	+13	-00	+06	25'48		
10	21°46'0	15°94'4	33'82	07'96	-49	-04	+05	25'38		
13	22°21'7	16°64'5	34'14	09'26	+16	-04	+06	25'06		
23	21°88'4	16°34'5	34'81	08'50	-1'06	-04	+05	25'26		
24	21°91'9	16°36'9	34'91	08'75	-1'08	-04	+05	25'09		
29	22°06'1	16°45'0	35'44	10'17	+19	-04	+05	25'47		
30	21°53'2	15°91'5	35'51	10'31	-11	-01	+06	25'14		
31	22°24'5	16°65'0	35'58	09'80	-24	-04	+05	25'55		
Apr. 9	21°64'6	16°01'4	36'36	10'65	-35	-06	+04	25'34		
14	21°50'6	15°85'6	36'85	11'07	-42	-04	+05	25'37		
17	22°28'1	16°55'0	37'02	12'95	+1'15	-04	+05	25'23		
18	21°50'1	15°77'0	37'10	12'95	+75	-01	+06	24'85		
19	22°13'3	16°45'2	37'18	11'79	-06	-04	+05	25'34		
20	22°85'5	17°19'2	37'28	11'37	-18	-12	+07	25'68		
21	21°71'0	16°01'5	37'39	12'12	-26	-09	+09	25'01		
23	21°57'4	15°87'7	37'62	12'16	-35	-04	+05	25'12		
24	21°74'8	16°01'9	27'73	12'90	+08	-04	+05	24'92		
25	22°05'6	16°37'6	37'83	11'77	-89	-04	+05	25'18		
29	21°82'7	16°07'0	38'06	13'55	+21	-04	+00	24'68		
May 1	22°03'1	16°30'6	38'15	12'81	-15	-04	+05	25'20		
2	22°24'8	16°45'7	38'22	14'34	+59	-01	+06	24'52		
4	21°63'2	16°99'4	38'40	10'79	-2'26	-04	+05	25'36		
5	22°22'4	16°52'5	38'52	12'21	-97	-04	+05	25'35		
6	22°20'3	16°45'3	38'63	13'39	+17	-04	+05	25'42		
10	22°26'0	16°48'2	39'01	14'04	+25	-04	+05	25'23		
11	21°50'2	15°71'0	39'06	14'36	+17	-02	+05	24'90		
14	21°85'6	16°05'9	39'18	14'48	+26	-04	+05	24'97		
15	22°08'0	16°29'5	39'22	14'20	+51	-04	+05	25'54		
18	22°82'7	16°98'9	39'42	15'43	+1'44	-04	+05	25'44		

Results from observations for the variation of latitude at Waikiki, Hawaiian Islands.

GROUP VIII, PAIR 4.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	°	'	"
1892.										
Feb. 3	8:23.3	24:88.0	21 09 56.68	+6 26.18	+1.50	+12	+05	21	16	24.53
8	9:20.9	25:90.3	56.43	27.28	+ .84	+12	+05			24.72
12	8:66.8	25:37.3	56.36	27.53	+ .31	+12	+05			24.37
21	8:47.6	25:21.9	56.53	28.41	— .30	+12	+05			24.81
27	8:38.8	25:04.8	56.70	26.49	+1.67	+12	+05			25.03
28	8:91.6	25:62.4	56.76	27.60	+ .17	+12	+05			24.70
29	8:51.6	25:28.7	56.84	29.06	—1.41	+12	+05			24.66
Mar. 2	7:95.5	24:66.9	56.94	27.74	— .46	+12	+05			24.39
5	8:59.5	25:36.9	57.00	29.13	—1.26	+12	+05			25.04
8	9:53.7	26:29.5	57.08	28.76	— .95	+12	+05			25.06
9	8:31.8	25:05.0	57.13	28.16	— .32	+12	+05			25.14
10	8:98.8	25:69.1	57.22	27.48	— .28	+12	+05			24.59
13	9:29.7	25:96.0	57.54	26.56	+ .10	+12	+05			24.37
21	8:41.1	25:18.7	57.57	29.18	—2.11	+08	+05			24.77
23	8:16.0	24:86.9	58.21	27.62	—1.20	+12	+05			24.80
24	8:01.5	24:70.5	58.31	27.18	— .90	+12	+05			24.76
29	8:18.4	24:80.1	58.86	25.49	+ .40	+12	+05			24.92
30	8:09.8	24:73.7	58.93	26.00	— .19	+12	+05			24.91
31	9:91.1	26:50.5	59.00	24.96	+ .67	+12	+05			24.80
Apr. 6	8:49.5	25:10.7	59.42	25.37	— .25	+06	+08			24.68
9	9:17.0	25:79.0	59.80	25.56	— .48	+12	+05			25.05
13	8:55.8	25:11.5	10 00.26	24.10	+ .12	+12	+05			24.65
14	8:39.7	24:98.8	00.33	24.89	— .31	+12	+05			25.08
17	8:74.9	25:29.6	00.52	23.86	+ .10	+12	+05			24.65
18	8:83.1	25:38.1	00.60	23.93	+ .33	+12	+05			25.03
19	8:92.3	25:46.6	00.68	23.77	+ .19	+12	+05			24.81
20	9:45.4	26:03.9	00.78	24.75	— .40	+12	+05			25.30
23	8:97.6	25:50.7	01.15	23.49	— .19	+12	+05			24.62
24	8:29.8	24:81.0	01.27	23.05	— .05	+12	+05			24.44
25	8:50.8	25:05.5	01.37	23.98	— .74	+12	+05			24.78
May 1	9:18.6	25:70.2	01.74	23.15	— .12	+12	+05			24.94
2	8:94.4	25:42.2	01.81	22.26	+ .70	+12	+05			24.94
4	9:00.3	25:46.5	02.00	21.89	+ .60	+12	+05			24.66
5	9:48.9	26:03.9	02.11	23.93	—1.11	+14	+05			25.12
6	9:20.6	25:65.6	02.24	21.61	+ .84	+12	+05			24.86
7	8:50.5	25:01.0	02.37	22.89	— .37	+12	+05			25.06
9	8:27.7	24:73.7	02.58	21.85	— .02	+10	+05			24.56
11	9:01.0	25:45.5	02.73	21.50	+ .39	+12	+05			24.79
14	8:38.7	24:84.0	02.86	21.68	— .18	+12	+05			24.53
15	9:05.7	25:49.7	02.90	21.38	+ .07	+12	+05			24.52
18	8:50.9	24:89.6	03.13	20.15	+1.35	+12	+05			24.80
22	8:57.1	24:97.7	03.50	20.59	+ .76	+12	+05			25.02
23	9:25.1	25:74.0	03.58	22.52	— .69	+12	+05			25.58

GROUP VIII, PAIR 5.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1892.			° ' "	' "	" "	" "	" "	° ' "
Feb. 3	23°34'2	13°70'3	21 20 07.75	-3 43.61	+ .96	- .07	+ .05	21 16 25.08
8	23°86'3	14°18'0	07.46	44.63	+1.71	- .07	+ .05	24.52
12	23°58'1	13°93'9	07.37	43.68	+1.02	- .07	+ .05	24.69
21	23°84'0	14°23'7	07.51	42.78	+ .14	- .09	+ .05	24.83
23	23°57'8	13°97'6	07.48	42.75	- .29	- .05	+ .05	24.44
27	23°78'2	14°11'1	07.64	44.35	+1.49	- .07	+ .05	24.76
28	23°66'0	14°10.5	07.70	41.66	-0.96	- .07	+ .05	25.06
29	23°67'3	14°11'7	07.78	41.68	-1.13	- .15	+ .08	24.90
Mar. 2	23°38'3	13°81'3	07.89	42.01	- .75	- .07	+ .05	25.11
5	24°05'4	14°48'1	07.96	42.08	-1.04	- .07	+ .05	24.82
9	22°68'4	13°05'9	08.08	43.29	+ .19	- .07	+ .05	24.96
10	24°57'5	14°94'6	08.17	43.38	- .41	- .07	+ .05	24.36
13	23°52'8	13°91'1	08.49	43.10	- .24	- .09	+ .05	25.11
21	23°36'0	13°81'6	09.05	41.41	-2.38	- .11	+ .04	25.19
23	23°68'9	14°08'2	09.20	42.87	-1.39	- .07	+ .05	24.92
24	23°82'3	14°22'1	09.29	42.75	1.75	- .07	+ .05	24.77
29	24°33'7	13°59'3	09.86	46.05	+ .62	- .07	+ .05	24.41
30	23°80'8	14°06'6	09.95	46.00	+ .43	- .07	+ .05	24.36
31	23°31'0	13°60'0	10.03	45.26	+ .45	- .07	+ .05	25.20
Apr. 6	23°44'6	14°72'4	10.47	45.53	- .11	- .11	+ .04	24.76
9	23°60'4	13°89'0	10.87	45.35	- .31	- .09	+ .05	25.17
14	23°87'1	14°10'1	11.45	46.65	- .32	- .07	+ .05	24.46
15	23°36'0	13°59'7	11.52	46.49	+ .04	- .12	+ .09	25.04
16	23°31'7	13°57'2	11.58	46.07	- .70	- .07	+ .05	24.79
18	23°06'2	13°27'0	11.74	47.16	+ .65	- .15	+ .08	25.16
19	23°75'5	13°95'4	11.83	47.37	- .06	- .07	+ .05	24.38
23	23°70'2	13°93'9	12.32	46.49	- .27	- .07	+ .05	25.54
24	23°35'2	13°54'0	12.46	47.62	- .07	- .07	+ .05	24.75
25	23°46'7	13°68'5	12.56	46.93	- .60	- .07	+ .05	25.01
May 2	23°56'9	13°71'8	13.06	48.53	+ .15	- .07	+ .05	24.66
4	23°48'2	13°54'4	13.26	50.55	+1.99	- .07	+ .05	24.68
5	23°83'9	14°04'2	13.39	47.27	-1.24	- .07	+ .05	24.86
9	23°71'6	13°80'3	14.07	51.08	+1.24	- .07	+ .05	24.21
14	23°58'4	13°66'5	14.23	50.11	+ .32	- .04	+ .06	24.46
18	23°36'6	13°39'8	14.53	51.24	+1.59	- .07	+ .05	24.86
22	23°59'0	13°70'2	14.94	49.39	-0.97	- .07	+ .05	24.56
23	23°33'4	13°46'7	15.02	48.90	-1.07	- .07	+ .05	25.03

Results from observations for the variation of latitude at Waikiki, Hawaiian Islands.

GROUP VIII, PAIR 6.

Date.	Micrometer.		Mean app. Dec.	*Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "			
1892.			° ' "	' "	" "	" "	" "	° ' "		
Feb. 3	22° 78' 3	14° 19' 6	21 19 43.28	-3 19.20	- .19	-.07	+.06	21 16 23.88		
8	22° 44' 8	13° 82' 2	42.98	20.11	+1.02	-.07	+.06	23.88		
12	22° 08' 5	13° 57' 2	42.86	17.49	-1.14	-.07	+.06	24.22		
23	22° 35' 2	13° 85' 1	42.95	17.21	-1.57	-.07	+.06	24.16		
27	22° 59' 6	13° 98' 9	43.08	19.67	+ .55	-.07	+.06	23.95		
28	22° 35' 3	13° 86' 5	43.14	16.91	-1.66	-.07	+.06	24.56		
Mar. 2	22° 23' 5	13° 72' 3	43.31	17.46	-1.28	-.07	+.06	24.56		
5	22° 40' 5	13° 93' 9	43.37	16.40	-1.94	-.07	+.06	25.02		
8	22° 32' 1	13° 81' 2	43.44	17.40	-1.29	+ .01	+.06	24.82		
9	21° 93' 9	13° 42' 2	43.47	17.58	-1.68	-.07	+.06	24.20		
10	22° 08' 4	13° 55' 0	43.57	17.98	- .84	-.07	+.06	24.74		
13	22° 50' 7	13° 94' 6	43.87	18.60	-1.26	-.07	+.06	24.00		
21	22° 46' 0	13° 92' 0	44.41	18.11	-1.88	-.05	+.06	24.43		
23	22° 76' 1	14° 24' 2	44.55	17.63	-2.38	-.07	+.06	24.53		
24	22° 23' 8	13° 69' 5	44.64	18.18	-1.73	-.07	+.06	24.72		
29	22° 42' 3	13° 78' 0	45.20	20.50	+ .09	-.05	+.06	24.80		
30	22° 27' 5	13° 63' 4	45.29	20.46	- .46	-.07	+.06	24.36		
31	22° 31' 0	13° 69' 0	45.36	19.97	- .90	-.07	+.06	24.46		
Apr. 9	22° 57' 7	13° 95' 2	46.18	20.09	-1.37	-.07	+.06	24.71		
15	22° 22' 2	13° 54' 8	46.83	21.22	-1.42	-.15	+.10	24.14		
16	22° 68' 2	14° 01' 6	46.89	21.04	-1.90	-.07	+.06	23.94		
19	23° 06' 4	14° 35' 8	47.13	21.97	- .81	-.07	+.06	24.34		
21	21° 84' 6	13° 17' 1	47.35	21.25	-1.56	-.07	+.06	24.53		
23	22° 37' 8	13° 67' 3	47.61	21.94	- .96	-.07	+.06	24.70		
24	23° 04' 3	14° 31' 0	47.75	22.59	- .77	-.07	+.06	24.38		
25	22° 57' 8	13° 87' 9	47.85	21.80	-1.40	-.07	+.06	24.64		
May 2	22° 93' 6	14° 17' 3	48.35	23.29	- .63	-.07	+.06	24.42		
5	21° 97' 8	13° 25' 0	48.67	22.48	-2.06	-.07	+.06	24.12		
9	22° 65' 6	13° 86' 2	49.18	24.01	- .26	-.04	+.06	24.93		
14	22° 05' 3	13° 24' 3	49.52	24.38	-1.02	-.07	+.06	24.11		
15	22° 55' 4	13° 76' 2	49.57	23.96	- .74	-.15	+.10	24.82		
18	22° 33' 7	13° 44' 5	49.82	26.28	+ .44	-.07	+.06	23.97		
22	22° 91' 0	14° 09' 2	50.23	24.56	-1.23	-.07	+.06	24.43		
23	22° 01' 9	13° 24' 1	50.31	23.64	-2.30	-.07	+.06	24.36		

GROUP VIII, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. / "	Level. "	Ref. "	Mer. "	
1892.								
Feb. 3	23°05'0	14°03'8	21 19 52.77	-3 29.06	+ .90	-.06	+.06	21 16 24.61
8	22°22'2	13°22'7	52.43	28.67	+ .39	-.06	+.06	24.15
12	22°62'8	13°70'8	52.28	26.93	-1.05	-.06	+.06	24.30
21	21°86'2	12°93'5	52.37	27.09	-1.21	-.06	+.06	24.07
23	22°33'1	13°42'5	52.33	26.61	-1.36	-.06	+.06	24.36
27	22°37'5	13°37'5	52.45	28.79	+ .57	-.06	+.06	24.23
28	21°97'0	13°05'4	52.50	26.84	-1.14	-.06	+.06	24.52
29	22°16'2	13°29'4	52.57	25.72	-2.11	-.06	+.06	24.74
Mar. 2	22°29'9	13°42'9	52.68	25.77	-1.77	-.06	+.06	25.14
5	21°85'2	13°01'9	52.76	24.91	-2.52	-.06	+.06	25.33
8	21°82'1	12°82'1	52.83	28.79	+ .06	-.04	+.06	24.12
9	22°57'6	13°67'3	52.87	26.54	-1.69	-.06	+.06	24.64
10	22°64'9	13°75'0	52.94	26.44	-1.38	-.06	+.06	25.12
13	22°91'7	13°97'5	53.25	27.44	-1.50	-.06	+.06	24.31
21	22°25'7	13°33'3	53.85	27.02	-2.08	-.06	+.06	24.75
23	22°06'1	13°13'4	54.00	27.09	-2.23	-.06	+.06	24.68
24	22°24'2	13°30'0	54.10	27.44	-2.20	-.06	+.06	24.46
29	23°09'5	14°05'5	54.70	29.71	- .19	-.06	+.06	24.80
30	22°98'1	13°93'7	54.80	29.81	- .37	-.06	+.06	24.62
31	22°79'1	13°74'4	54.88	29.88	- .62	-.06	+.06	24.38
Apr. 6	22°72'4	13°68'2	55.36	29.76	-1.04	-.10	+.04	24.50
9	23°23'7	14°21'9	55.78	29.20	-1.82	-.06	+.06	24.76
16	22°93'0	13°86'1	56.59	30.39	-2.08	-.10	+.04	24.06
17	22°99'2	13°82'6	56.68	32.64	- .14	-.06	+.06	23.90
18	22°89'7	13°78'7	56.76	31.34	- .78	-.06	+.06	24.64
19	22°76'6	13°66'6	56.86	31.11	-1.17	-.06	+.06	24.58
21	22°66'6	13°55'2	57.10	31.43	-1.18	-.03	+.06	24.52
24	22°53'1	13°39'3	57.53	31.99	- .54	-.06	+.06	25.00
May 1	22°60'7	13°44'2	58.18	32.61	-1.03	-.06	+.06	24.54
2	22°85'7	13°68'3	58.27	32.82	- .58	-.06	+.06	24.87
4	22°76'7	13°47'5	58.49	35.56	+ .65	-.06	+.06	23.58
5	22°73'1	13°60'1	58.62	31.80	-2.02	-.06	+.06	24.80
10	22°93'0	13°70'1	59.31	34.10	- .63	-.06	+.06	24.58
15	22°72'5	13°47'5	59.68	34.59	- .91	-.06	+.06	24.18
18	22°39'5	13°08'3	59.96	36.02	+ .66	-.06	+.06	24.60
22	22°13'4	12°89'5	20 00 00.43	34.33	-1.37	-.06	+.06	24.73
23	22°17'0	12°95'9	00.53	33.68	-2.34	-.06	+.06	24.51

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP VIII, PAIR 8.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	<i>N.</i> <i>t. d.</i>	<i>S.</i> <i>t. d.</i>		<i>Mic.</i> " "	<i>Level.</i> " "	<i>Ref.</i> " "	<i>Mer.</i> " "	
1892.			° ' "					° ' "
Feb. 3	24-63.1	11-53.3	21 21 27-66	-5 03-85	+1-07	-08	+05	21 16 24-85
8	24-72.5	11-61.5	27-29	04-13	+1-10	-08	+05	24-23
12	24-69.8	11-62.6	27-12	03-25	+0-60	-08	+05	24-44
21	23-44.8	10-41.1	27-17	02-44	-0-29	-08	+05	24-41
23	24-32.4	11-28.3	27-13	02-53	-0-31	-08	+05	24-26
27	25-38.1	11-30.0	27-23	03-46	+1-44	-06	+04	25-19
28	24-06.2	11-02.8	27-28	02-37	-0-24	-08	+05	24-64
29	23-85.7	10-85.0	27-35	01-74	-0-83	-08	+05	24-76
Mar. 2	23-93.9	10-92.1	27-45	02-00	-1-08	-08	+05	24-34
5	23-94.3	11-00.4	27-53	00-17	-2-23	-08	+05	25-10
8	24-05.5	11-01.8	27-60	02-44	-0-45	-08	+05	24-68
9	24-30.5	11-29.5	27-65	01-81	-1-22	-08	+05	24-59
10	23-85.5	10-80.7	27-72	02-69	-0-94	-08	+05	24-06
21	24-03.5	11-01.1	28-67	02-14	-1-96	-08	+05	24-54
23	24-11.5	11-08.6	28-82	02-25	-1-52	-08	+05	25-02
24	24-38.1	11-31.5	28-91	03-11	-1-34	-08	+05	24-43
29	24-03.6	10-86.9	29-55	05-45	+0-03	-08	+05	24-10
30	24-32.4	11-22.5	29-65	03-88	-0-71	-08	+05	25-03
31	24-63.1	11-47.2	29-74	05-27	+0-24	-08	+05	24-68
Apr. 6	23-80.0	10-63.8	30-26	05-34	-0-05	-08	+05	24-84
9	24-18.9	11-01.5	30-70	05-62	-0-45	-08	+05	24-60
13	23-52.0	10-29.7	31-29	06-75	-0-32	-08	+05	24-19
14	24-60.5	11-41.7	31-40	05-94	-0-59	-08	+05	24-84
16	24-36.1	11-15.2	31-58	06-43	-0-80	-08	+05	24-32
18	23-93.5	10-67.3	31-77	07-66	+0-85	-08	+03	24-91
19	24-21.8	10-98.6	31-89	06-96	-0-22	-08	+05	24-68
20	23-95.1	10-72.1	32-00	06-92	-0-79	-05	+06	24-30
21	24-03.3	10-82.4	32-13	06-43	-0-71	-08	+05	24-96
24	23-73.3	10-46.8	32-59	07-73	-0-24	-08	+05	24-59
25	23-95.5	10-71.0	32-73	07-26	-0-42	-08	+03	25-00
May 1	24-48.1	11-20.2	33-33	08-05	-0-69	-10	+04	24-53
2	24-22.1	10-92.5	33-42	08-45	-0-24	-08	+05	24-70
4	24-33.0	10-93.8	33-67	10-67	+1-57	-08	+05	24-54
5	23-97.7	10-69.2	33-81	8-19	-1-09	-08	+05	24-50
9	23-74.4	10-40.8	34-43	09-37	-0-62	-08	+05	24-40
10	23-95.0	10-60.0	34-56	9-70	00	-08	+05	24-83
14	24-00.0	10-64.2	34-92	9-89	-0-13	-12	+04	24-82
22	24-31.8	10-93.5	35-82	10-47	-0-92	-08	+05	24-40
23	23-74.2	10-40.8	35-94	9-33	-2-26	-08	+05	24-32

GROUP I, PAIR 1.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1892.			° ' "	' "	" "	" "	" "	° ' "
Apr. 9	10°52'2	14°54'8	21 14 52'41	+1 33'40	— '61	+ '05	+ '07	21 16 25'32
19	13°76'8	17°75'0	53'59	32'38	— 1'19	+ '03	+ '07	24'88
24	13°62'2	17°56'9	54'28	31'56	— '82	+ '03	+ '07	25'12
25	13°88'2	17°86'3	54'43	32'35	— 1'49	+ '01	+ '04	25'34
May 1	13°70'5	17°65'9	55'11	31'73	— 1'86	+ '03	+ '07	25'08
4	14°28'5	18°04'4	55'44	27'20	+ 1'48	+ '03	+ '07	24'22
5	14°17'2	18°08'7	55'58	30'82	— 1'43	+ '03	+ '07	25'07
9	13°60'7	17°42'1	56'24	28'48	— '26	+ '03	+ '07	24'56
10	13°69'8	17°54'0	56'40	29'13	— '79	+ '03	+ '07	24'84
13	13°25'0	17°03'8	56'76	27'88	— '10	+ '03	+ '07	24'64
14	13°02'5	17°74'6	56'86	28'64	— 1'08	+ '03	+ '07	24'52
15	15°09'0	18°89'2	56'95	28'20	— '38	+ '03	+ '07	24'87
18	13°60'9	17°42'3	57'26	28'48	— '54	+ '03	+ '07	25'30
21	13°42'1	17°23'8	57'70	28'55	— 1'49	+ '03	+ '07	24'86
22	14°01'3	17°85'7	57'84	29'18	— 2'09	+ '03	+ '07	25'03
24	14°45'9	18°15'4	58'11	25'72	+ '85	+ '03	+ '07	24'78
25	13°69'1	17°48'1	58'23	27'92	— 1'55	+ '03	+ '07	24'70
26	13°65'3	17°39'5	58'32	26'81	— '84	— '01	+ '05	24'34
28	14°43'6	18°17'5	58'48	26'74	— '68	+ '03	+ '07	24'64
29	15°18'2	19°03'6	58'56	29'41	— 2'97	+ '03	+ '07	25'10
June 3	13°82'5	17°41'7	59'14	23'33	+ 1'95	+ '03	+ '07	24'52
4	14°60'5	18°40'3	59'28	28'11	— 2'59	+ '03	+ '07	24'90
5	15°07'4	18°80'5	59'42	26'55	— 1'25	+ '03	+ '07	24'82
7	14°36'3	17°95'9	59'68	23'42	+ 1'22	+ '03	+ '07	24'42
11	14°44'8	18°06'9	59'98	24'00	+ '82	+ '03	+ '07	24'90
13	13°89'2	17°51'0	15 00'10	23'93	— '06	+ '03	+ '07	24'07
17	14°57'0	18°16'7	00'49	23'44	+ '63	+ '01	+ '05	24'62
18	14°40'0	18°09'0	00'60	25'60	— 1'12	+ '03	+ '07	25'18
19	13°81'9	17°57'8	00'71	27'20	— 2'87	+ '03	+ '07	25'14
22	14°25'4	17°81'4	00'94	22'59	+ 1'02	+ '03	+ '07	24'65
24	13°51'3	17°11'6	01'02	23'58	— '18	+ '03	+ '07	24'52
25	15°07'1	18°71'3	01'04	24'49	— '89	+ '03	+ '07	24'74

Results from observations for the variation of latitude at Waikiki, Hawaiian Islands.

GROUP I, PAIR 2.

Date.	Micrometer.		Mean app. Dec.			Corrections.				Latitude.		
	N. t. d.	S. t. d.	°	'	"	Mic. "	Level. "	Ref. "	Mer. "	°	'	"
1892.												
Apr. 9	13°74'3	15°75'3	21	17	09.70	—0	46.65	+1.23	—02	+05	21	16 24.31
16	14°58'5	16°65'6			10.76		48.04	+1.92	—02	+05		24.67
19	14°38'3	16°43.4			11.10.		47.58	+ .63	—02	+05		24.18
23	14°76'8	16°79.3			11.72		46.98	— .13	—02	+05		24.64
24	14°16'3	16°22.6			11.90		47.86	+ .66	—02	+05		24.73
25	13°80.1	16°84.1			12.08		47.32	— .21	—02	+05		24.58
May 4	14°31'3	16°56.6			13.34		52.27	+3.42	—02	+05		24.52
5	14°64.5	16°76.1			13.51		49.09	— .13	—02	+05		24.32
9	14°27.3	16°49.8			14.28		51.62	+1.19	—02	+05		23.88
10	14°34.6	16°54.8			14.47		51.08	+ .68	—02	+05		24.10
13	14°13'7	16°38.8			14.92		52.22	+2.06	—02	+05		24.79
14	14°46.5	16°68.1			15.04		51.41	+ .90	—02	+05		24.56
15	13°99.1	16°23.7			15.16		52.10	+1.23	—02	+05		24.32
18	13°91.5	16°17.7			15.57		52.48	+1.52	—02	+05		24.64
21	14°39.9	16°62.1			16.08		51.55	+ .16	—02	+05		24.72
22	15°68.3	17°87.1			16.26		50.76	— .73	—02	+05		24.80
23	14°16.2	16°34.7			16.44		50.69	—1.21	—02	+05		24.57
24	13°94.4	16°30.3			16.59		54.72	+2.13	—02	+05		24.03
25	14°42.9	16°75.0			16.74		53.84	+1.54	—02	+05		24.47
26	13°06.0	15°36.2			16.86		53.40	+1.28	—10	+07		24.71
28	14°40.3	16°73.7			17.09		54.14	+1.14	—02	+05		24.12
29	13°87.8	16°23.3			17.20		54.63	+2.16	—02	+05		24.76
30	13°76.6	16°12.0			17.31		54.61	+1.47	+02	+04		24.23
June 3	14°03.6	16°43.9			17.90		55.75	+2.81	—02	+05		24.99
4	14°09.1	16°38.4			18.08		52.36	—1.12	—00	+04		24.64
5	14°32.2	16°66.0			18.25		54.24	+ .10	—02	+05		24.14
6	14°54.4	16°89.4			18.41		54.52	+ .50	—02	+05		24.42
7	14°14.3	16°66.6			18.56		58.53	+3.62	—02	+05		23.68
11	14°59.9	17°05.8			18.98		57.04	+2.14	—02	+04		24.10
13	14°37.9	16°80.1			19.16		56.19	+1.50	—02	+05		24.50
14	14°50.2	16°90.7			19.26		55.79	+ .76	—02	+05		24.26
17	13°83.4	16°33.8			19.65		58.09	+2.86	—02	+05		24.45
18	13°89.6	16°27.7			19.80		55.24	+ .12	—02	+05		24.71
22	14°83.0	17°34.4			20.24		58.32	+2.33	—02	+05		24.28
24	13°79.5	16°36.9			20.38		59.71	+2.92	—02	+05		23.62
25	14°69.8	17°13.5			20.43		56.53	+ .36	—02	+05		24.29

GROUP I, PAIR 3.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "			
1892.			° ' "					° ' "		
Apr. 9	19°26'6	15°45'3	21 17 52.96	-1 28.46	+ .29	-03	+06	21 16 24.82		
16	20°70'1	17°81'1	53.97	30.24	+ .99	-03	+06	24.75		
19	21°01'7	17°11'9	54.27	30.43	+ .78	-03	+06	24.65		
23	20°51'8	16°61'7	54.83	30.50	+ .34	-03	+06	24.70		
24	20°52'8	16°59'1	55.00	31.33	+ .86	-03	+06	24.56		
25	21°10'7	17°17'7	55.18	31.17	+ .42	-03	+06	24.46		
May 1	21°66'6	17°69'1	56.00	32.21	- .23	-23	+29	23.62		
4	21°07'1	16°97'4	56.37	35.04	+3.52	-03	+06	24.88		
5	20°84'3	16°88'6	56.52	31.80	+ .11	-03	+06	24.86		
9	21°39'7	17°38'6	57.26	33.05	+ .14	-03	+06	24.38		
13	20°89'1	16°85'9	57.88	33.54	- .35	-03	+06	24.02		
14	21°15'7	17°06'0	58.00	35.04	+1.52	-03	+06	24.51		
15	20°73'0	16°67'3	58.11	34.12	+ .19	-03	+06	24.21		
18	20°78'5	16°69'1	58.48	34.97	+1.26	-03	+06	24.80		
21	20°79'1	16°76'3	58.96	33.44	- .88	-03	+06	24.67		
22	21°13'7	17°12'0	59.14	33.19	- .90	-03	+06	25.08		
23	20°75'2	16°72'1	59.31	33.51	-1.41	-03	+06	24.42		
24	20°89'3	16°82'7	59.46	34.32	- .42	-03	+06	24.75		
25	20°51'6	16°37'6	59.62	36.04	+ .77	-03	+06	24.38		
26	20°04'9	15°91'2	59.74	35.97	+ .59	+01	+05	24.42		
27	21°13'6	17°03'1	59.86	35.23	- .36	-03	+06	24.30		
28	20°55'5	16°39'1	59.96	36.60	+1.18	-03	+06	24.57		
29	20°76'1	16°55'5	18 00.06	37.57	+2.28	-03	+06	24.80		
June 3	21°68'7	17°44'5	00.72	38.41	+2.06	-03	+06	24.40		
4	21°01'7	16°92'3	00.89	34.98	-1.49	-03	+06	24.45		
5	21°64'0	17°54'4	01.06	35.02	-1.15	-03	+06	24.92		
7	21°20'5	16°90'6	01.38	39.73	+2.61	-03	+06	24.29		
11	21°80'2	17°53'6	01.79	38.96	+1.46	-03	+06	24.32		
12	21°18'5	16°96'6	01.88	37.88	+ .44	-03	+06	24.47		
13	21°38'4	17°27'8	01.96	37.57	+ .64	-03	+06	25.06		
14	21°02'3	16°80'2	02.06	37.92	+ .38	-03	+06	24.55		
17	22°02'7	17°71'9	02.42	39.94	+1.97	-03	+06	24.48		
18	20°99'2	16°81'3	02.56	36.95	- .84	-03	+06	24.80		
22	20°55'7	16°22'2	03.02	40.56	+1.30	+05	+10	23.91		
24	20°73'4	16°46'1	03.16	39.13	+ .06	-03	+06	24.12		
25	21°11'3	16°84'0	03.20	39.13	+ .16	-03	+06	24.26		

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP 1, PAIR 4.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. ' "	Level. " "	Ref. " "	Mer. " "	
1892.			° ' "					° ' "
Apr. 9	13° 99' 4	22° 18' 5	21 13 14 39	+3 10' 02	+ ' 21	+ ' 05	+ ' 05	21 16 24' 72
16	14° 19' 3	22° 27' 0	15' 50	07' 37	+1' 71	+ ' 05	+ ' 05	24' 68
19	13° 83' 4	21° 08' 0	15' 85	08' 98	— ' 13	+ ' 05	+ ' 05	24' 80
23	13° 58' 2	21° 69' 8	16' 48	08' 28	— ' 18	+ ' 05	+ ' 05	24' 68
24	13° 81' 8	21° 91' 9	16' 66	07' 93	+ ' 07	+ ' 05	+ ' 05	24' 76
May 1	14° 03' 5	22° 11' 6	17' 80	07' 46	— ' 32	+ ' 05	+ ' 05	25' 04
4	13° 44' 7	21° 53' 5	18' 22	07' 63	—1' 26	+ ' 05	+ ' 05	24' 69
5	13° 73' 5	21° 78' 6	18' 45	06' 77	— ' 50	+ ' 05	+ ' 05	24' 82
9	13° 95' 3	21° 93' 4	19' 22	05' 15	— ' 18	+ ' 05	+ ' 05	24' 29
13	13° 85' 2	21° 77' 5	19' 94	03' 80	+ ' 47	+ ' 05	+ ' 05	24' 31
14	14° 29' 0	22° 22' 7	20' 08	04' 13	+ ' 20	+ ' 05	+ ' 05	24' 51
15	13° 51' 7	21° 44' 0	20' 22	03' 80	+ ' 18	+ ' 05	+ ' 05	24' 30
18	13° 88' 7	21° 77' 5	20' 66	02' 99	+1' 01	+ ' 05	+ ' 05	24' 76
21	13° 42' 5	21° 39' 8	21' 22	04' 96	—1' 28	+ ' 05	+ ' 05	25' 00
22	13° 99' 4	21° 91' 7	21' 41	03' 80	—1' 16	+ ' 05	+ ' 05	24' 15
23	13° 75' 7	21° 71' 9	21' 61	04' 71	—1' 56	+ ' 05	+ ' 05	24' 86
24	13° 50' 3	21° 39' 9	21' 79	03' 18	— ' 49	+ ' 05	+ ' 05	24' 58
25	13° 47' 9	21° 35' 0	21' 97	02' 60	+ ' 15	+ ' 05	+ ' 05	24' 82
26	13° 60' 8	21° 45' 7	22' 12	02' 08	+ ' 16	+ ' 05	+ ' 05	24' 46
27	13° 94' 9	21° 78' 7	22' 26	01' 83	+ ' 52	+ ' 05	+ ' 06	24' 72
28	14° 32' 0	22° 17' 7	22' 39	02' 27	— ' 04	+ ' 05	+ ' 05	24' 72
29	13° 69' 9	22° 48' 7	22' 52	00' 67	+1' 13	+ ' 05	+ ' 05	24' 42
June 3	14° 56' 1	22° 28' 5	23' 30	+2 59' 18	+1' 89	+ ' 05	+ ' 05	24' 47
4	14° 34' 6	22° 22' 2	23' 50	+3 02' 71	—1' 37	+ ' 05	+ ' 05	24' 94
5	14° 19' 3	22° 04' 8	23' 69	02' 22	—1' 05	+ ' 05	+ ' 05	24' 96
7	14° 36' 9	22° 18' 4	24' 06	01' 30	— ' 55	+ ' 05	+ ' 05	24' 91
11	14° 51' 6	22° 17' 9	24' 59	+2 57' 77	+1' 18	+ ' 05	+ ' 05	23' 64
12	14° 06' 2	21° 79' 7	24' 70	59' 44	+ ' 28	+ ' 05	+ ' 05	24' 52
13	14° 69' 1	22° 42' 2	24' 81	59' 35	+ ' 67	+ ' 05	+ ' 05	24' 93
14	14° 08' 8	21° 81' 0	24' 94	59' 14	+ ' 36	+ ' 05	+ ' 05	24' 54
17	14° 12' 3	21° 91' 8	25' 38	+3 00' 83	—1' 26	+ ' 05	+ ' 05	25' 05
18	13° 89' 2	21° 66' 7	25' 54	00' 37	—1' 42	+ ' 05	+ ' 05	24' 59
22	14° 58' 3	22° 22' 0	26' 11	+2 57' 17	+1' 12	+ ' 05	+ ' 05	24' 50
24	13° 96' 4	21° 67' 8	26' 30	58' 95	— ' 55	+ ' 05	+ ' 05	24' 80
25	14° 26' 8	21° 96' 8	26' 38	58' 63	— ' 28	+ ' 05	+ ' 05	24' 83

GROUP 1, PAIR 5.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. " "	Level. " "	Ref. " "	Mer. " "	
1892.			° ' "					° ' "
Apr. 9	8:59.8	25:36.1	21 10 00.33	+6 24.24	+ .72	+ .10	+ .05	21 16 25.44
16	9:04.7	25:50.3	01.43	21.52	+2.22	+ .10	+ .05	25.32
19	9:06.6	26:10.8	01.78	21.43	+2.04	+ .10	+ .05	25.40
23	8:77.0	25:22.9	12.39	21.82	+ .68	+ .10	+ .05	25.04
24	9:32.7	25:79.1	02:58	21.94	+ .61	+ .10	+ .05	25.28
25	9:23.5	25:09.1	12.77	21.75	+ .15	+ .10	+ .05	24.82
May 1	9:24.4	25:66.3	03.71	20.90	+ .27	+ .06	+ .04	24.98
4	9:33.4	25:75.9	04.14	21.04	— .41	+ .10	+ .05	24.92
5	9:08.9	25:49.8	04.30	20.66	+ .20	+ .06	+ .06	25.28
9	8:57.8	24:93.8	05.12	19.53	+ .26	+ .10	+ .05	25.06
13	9:11.4	25:41.6	05.85	18.18	+ .67	+ .10	+ .05	24.85
14	8:90.4	25:21.6	05.98	18.41	+ .10	+ .10	+ .05	24.64
15	8:27.1	24:56.0	06.12	17.88	+ .48	+ .06	+ .04	24.58
18	9:38.1	25:62.4	06.56	16.81	+1.44	+ .10	+ .05	24.96
21	9:09.9	25:21.1	07.09	13.77	+3.89	+ .10	+ .05	24.90
22	9:42.8	25:76.8	07.30	19.06	—1.47	+ .10	+ .05	25.04
23	8:54.1	24:90.7	07.52	19.67	—1.98	+ .10	+ .05	25.36
24	9:63.1	25:89.2	07.70	17.23	+ .14	+ .10	+ .05	25.22
25	8:98.9	25:20.8	07.88	16.26	+ .76	+ .10	+ .05	25.05
26	9:16.8	25:39.6	08.03	16.47	+ .31	+ .10	+ .05	24.96
27	8:78.3	25:00.0	08.18	16.21	— .03	+ .10	+ .05	24.51
28	9:09.2	25:32.0	08.30	16.47	+ .40	+ .10	+ .05	25.32
29	9:15.8	25:35.0	08.43	15.63	+ .93	+ .10	+ .05	25.14
June 3	9:45.0	25:59.7	09.22	14.59	+1.02	+ .10	+ .05	24.98
4	9:80.2	26:02.9	09.41	16.44	—1.10	+ .10	+ .05	24.90
5	9:53.3	25:76.0	09.61	16.44	— .96	+ .10	+ .05	25.24
7	9:61.5	25:78.3	09.98	15.07	+ .06	+ .10	+ .05	25.26
11	9:31.2	25:40.6	10.52	13.36	+1.01	+ .10	+ .05	25.04
12	9:33.9	25:49.2	10.63	14.73	— .05	+ .10	+ .05	25.46
13	9:78.7	25:87.5	10.74	13.22	+ .74	+ .10	+ .05	24.85
14	9:12.5	25:24.7	10.86	14.01	.00	+ .10	+ .05	25.02
17	9:62.1	25:78.3	11.30	14.93	—1.28	+ .10	+ .05	25.10
18	8:95.6	25:10.4	11.48	14.61	—1.04	+ .10	+ .05	25.20
22	9:61.7	25:65.9	12.05	12.15	+ .77	+ .10	+ .05	25.12
24	9:40.9	25:46.0	12.24	12.36	+ .01	+ .10	+ .05	24.76
25	9:23.2	25:30.1	12.33	12.78	— .06	+ .10	+ .05	25.20

Results from observations for the variation of latitude at Waikiki, Hawaiian Islands.

GROUP I, PAIR 6.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. "	Level. "	Ref. "	Mer. "	
1892.			° ' "					° ' "
April 9	25°50'6	13°06'4	21 21 12'44	—4 48'64	+ '77	—'09	+ '06	21 16 24'54
19	25°20'9	12°70'7	13'86	50'03	+ '56	—'09	+ '06	24'36
23	26°10'2	13°59'9	14'46	50'05	+ '29	—'09	+ '06	24'67
24	25°33'6	12°77'9	14'64	51'30	+ '10	—'09	+ '06	24'41
25	25°33'5	12°83'9	14'84	49'89	— '07	—'07	+ '05	24'86
May 1	25°81'5	13°27'0	15'78	51'02	— '30	—'13	+ '05	24'38
4	26°16'5	13°65'0	16'19	50'33	— '89	—'09	+ '06	24'94
5	25°50'1	12°94'3	16'36	51'33	— '22	—'09	+ '06	24'78
9	25°31'9	12°70'0	17'16	52'74	+ '15	—'09	+ '06	24'54
13	25°53'7	12°85'3	17'90	54'25	+ '82	—'09	+ '06	24'44
14	25°34'1	12°66'4	18'04	54'09	+ '38	—'09	+ '06	24'30
15	25°44'0	12°77'1	18'18	53'90	+ '38	—'09	+ '06	24'63
18	25°66'6	12°94'9	18'61	55'02	+ '12	—'09	+ '06	24'68
21	25°60'1	12°94'8	19'16	53'53	— '77	—'09	+ '06	24'83
22	25°56'1	12°91'6	19'36	53'34	— '33	—'09	+ '06	24'66
23	25°15'6	12°51'3	19'56	53'30	— '49	—'09	+ '06	24'74
24	25°13'8	12°43'5	19'75	54'69	— '49	—'09	+ '06	24'54
25	25°76'9	13°02'2	19'93	55'71	+ '55	—'09	+ '06	24'74
26	25°54'7	12°78'6	20'08	56'04	+ '58	—'09	+ '06	24'59
27	24°95'0	12°18'6	20'24	56'11	+ '13	—'09	+ '01	24'18
28	25°42'7	12°67'8	20'36	55'76	'00	—'09	+ '06	24'57
29	25°27'6	12°47'4	20'49	56'99	+ '15	—'09	+ '06	24'62
June 3	26°03'8	13°25'9	21'28	56'45	— '14	—'09	+ '06	24'66
4	25°78'4	13°03'2	21'48	55'83	— '93	—'09	+ '06	24'69
5	26°06'7	13°29'5	21'68	56'29	— '65	—'09	+ '06	24'71
11	26°74'3	13°84'8	22'61	59'14	+ '04	—'09	+ '06	24'48
13	25°81'2	12°93'7	22'84	58'68	+ '45	—'09	+ '06	24'58
14	26°17'0	13°29'7	22'96	58'64	+ '12	—'09	+ '06	24'41
17	25°88'2	13°02'4	23'41	58'29	— '92	—'05	+ '05	24'20
18	25°69'3	12°84'9	23'58	—4 57'96	— '89	—'09	+ '06	24'70
22	25°88'0	12°90'7	24'18	—5 00'96	+ '56	—'09	+ '06	24'75
24	25°99'5	13°11'3	24'38	—4 58'84	— '78	—'09	+ '06	24'73
25	25°47'4	12°56'2	24'48	59'54	— '13	—'09	+ '06	24'78

GROUP I, PAIR 7.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.		
	N. t. d.	S. t. d.		Mic. ' "	Level. ' "	Ref. ' "	Mer. ' "			
1892.			° ' "	' "	' "	' "	' "	° ' "		
April 9	15°49'8	18°22'5	21 15 20'28	+1 03'26	+ '54	+ '02	+ '06	21 16 24'16		
19	14°83'8	17°50'4	21'74	01'85	+ '85	+ '02	+ '06	24'52		
23	15°27'4	17°91'9	22'36	01'36	+ '65	+ '02	+ '06	24'45		
24	14°95'5	17°55'7	22'56	00'36	+1'19	+ '02	+ '06	24'19		
25	14°97'8	17°59'1	22'75	00'62	+ '45	+ '02	+ '06	23'90		
May 1	15°82'0	18°44'8	23'76	00'97	— '09	+ '02	+ '06	24'72		
4	15°51'7	18°12'4	24'20	00'48	— '13	+ '02	+ '06	24'63		
5	14°87'1	17°45'7	24'37	59'99	— '15	+ '02	+ '06	24'29		
9	15°03'0	17°57'3	25'22	58'99	— '12	+ '02	+ '06	24'17		
13	14°65'6	17°12'4	26'02	57'25	+ '63	+ '02	+ '06	23'98		
14	14°65'0	17°10'4	26'17	56'93	+ '92	+ '02	+ '06	24'10		
15	15°42'9	17°90'3	26'32	57'39	+ '11	+ '02	+ '06	23'90		
18	14°90'2	17°31'7	26'78	56'02	+1'62	+ '02	+ '06	24'50		
21	14°62'1	17°09'7	27'38	57'44	— '27	+ '02	+ '06	24'63		
22	15°31'7	17°33'1	27'60	58'32	—1'23	+ '02	+ '06	24'77		
23	14°78'9	17°27'2	27'81	57'60	—1'13	+ '02	+ '06	24'36		
24	15°80'4	18°26'3	28'02	57'04	— '78	+ '02	+ '06	24'36		
25	15°31'2	17°66'0	28'22	54'47	+1'26	+ '02	+ '06	24'03		
26	15°07'0	17°44'8	28'39	55'17	+ '77	+ '02	+ '06	24'41		
27	15°31'1	17°70'6	28'56	55'56	+ '14	+ '09	+ '05	24'40		
28	15°28'4	17°63'3	28'71	54'49	+1'10	+ '02	+ '06	24'38		
29	15°19'9	17°53'2	28'86	54'12	+1'28	+ '02	+ '06	24'34		
June 3	15°56'2	17°91'1	29'70	54'49	+ '31	+ '02	+ '06	24'58		
4	14°99'3	17°33'1	29'92	54'24	— '10	+ '02	+ '06	24'14		
5	15°83'2	18°16'3	30'14	54'08	— '07	+ '02	+ '06	24'23		
7	15°30'7	17°60'5	30'56	53'31	+ '22	+ '02	+ '06	24'17		
11	15°32'3	17°53'3	31'20	51'27	+1'80	+ '02	+ '06	24'35		
13	15°41'5	17°66'2	31'46	52'13	+ '87	+ '02	+ '06	24'54		
17	15°70'8	17°98'1	32'10	52'73	— '53	+ '02	+ '06	24'38		
18	15°47'0	17°69'0	32'28	51'50	+ '18	+ '02	+ '04	24'02		
22	15°27'1	17°38'8	32'98	49'11	+1'85	+ '02	+ '06	24'02		
24	15°30'1	17°44'7	33'22	49'78	+ '24	+ '02	+ '06	23'32		
25	15°80'5	17°95'4	33'34	49'85	+ '37	+ '02	+ '06	23'64		

GROUP II, PAIR 1.

1892.	t. d.		° ' "	' "	' "	' "	' "	° ' "		
	t. d.	t. d.								
May 22	7°38'6	28°52'8	21 08 14'84	+8 10'46	— '63	+ '14	+ '05	21 16 24'86		
25	7°65'5	28°64'9	15'57	07'03	+ '85	+ '14	+ '05	23'64		
28	8°13'5	29°08'8	16'19	06'08	+1'81	+ '14	+ '05	24'27		
June 7	9°42'4	30°35'9	18'33	05'66	+ '06	+ '14	+ '05	24'24		
11	8°69'9	29°52'6	19'16	03'16	+1'00	+ '14	+ '05	23'51		
13	7°74'4	28°61'0	19'51	04'06	+ '64	+ '14	+ '05	24'40		
14	7°32'1	28°18'4	19'68	03'99	+ '44	+ '14	+ '05	24'30		
18	7°64'0	28°53'7	20'52	04'78	—1'02	+ '14	+ '05	24'47		
23	7°76'4	28°51'7	21'62	01'44	+ '54	+ '14	+ '05	23'79		
25	7°67'9	28°45'4	21'96	01'95	— '01	+ '14	+ '05	24'09		

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

GROUP II, PAIR 2.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	N. t. d.	S. t. d.		Mic. "	Level. "	Ref. "	Mer. "	
1892.			° ' "	" "	" "	" "	" "	° ' "
May 22	16°33'3	17°95'0	21 16 00.98	+0 23.59	— .24	+0.01	+0.05	21 16 24.39
25	16°51'2	17°41'4	01.74	20.92	+1.41	+0.01	+0.05	24.13
28	16°77'4	17°62'6	02.38	19.76	+1.94	+0.01	+0.05	24.14
June 7	17°21'6	18°02'7	04.58	18.81	+ .68	+0.01	+0.05	24.13
11	17°12'0	17°86'3	05.44	17.24	+1.32	+0.01	+0.05	24.06
13	17°19'7	17°94'7	05.80	17.40	+1.19	+0.01	+0.05	24.45
14	17°77'1	18°50'6	05.99	17.05	+ .96	+0.03	+0.05	24.08
17	16°83'9	17°64'0	06.61	18.58	— .65	+0.01	+0.03	25.82
18	17°02'0	17°77'6	06.82	17.54	— .13	+0.01	+0.05	24.29
25	17°00'5	17°67'0	08.36	15.43	+ .11	+0.01	+0.05	23.96

GROUP II, PAIR 3.

1892.								
May 22	27°87'9	9°11'9	21 23 41.53	—7 15.20	— .88	— .13	+0.05	21 16 25.37
25	27°12'3	8°20'1	42.29	18.96	+1.99	— .13	+0.05	25.24
28	27°34'6	8°44'5	42.96	18.48	+ .78	— .13	+0.05	25.18
June 7	27°24'7	8°30'4	45.17	19.45	— .32	— .13	+0.05	25.32
11	27°51'1	8°44'8	46.08	22.23	+ .85	— .13	+0.05	24.62
13	27°49'5	8°48'0	46.44	21.12	+ .58	— .13	+0.05	25.82
18	27°79'5	8°76'5	47.50	21.47	—0.56	— .13	+0.05	25.39
25	27°70'2	8°58'3	49.06	23.53	— .33	— .13	+0.05	25.12

GROUP II, PAIR 4.

1892.								
May 22	18°88'7	15°88'7	26 17 35.30	—1 09.60	—1.19	—0.02	+0.05	21 16 24.54
25	18°22'8	15°10'3	36.06	12.50	+ .50	—0.02	+0.05	24.09
28	18°16'1	14°97'3	36.72	13.96	+1.17	—0.02	+0.05	23.96
June 7	18°14'5	14°92'7	38.98	14.65	— .04	—0.02	+0.05	24.32
11	18°15'8	14°81'7	39.89	17.51	+1.25	—0.02	+0.05	23.66
13	18°68'6	15°39'9	40.26	16.25	+ .21	—0.02	+0.05	24.25
18	18°59'7	15°31'8	41.34	16.07	— .91	—0.02	+0.05	24.39
25	18°45'0	15°16'8	42.95	18.46	— .44	—0.02	+0.05	24.08

GROUP II, PAIR 5.

1892.								
May 22	11°08'8	26°47'8	21 10 28.40	+5 57.02	— .77	+1.10	+0.05	21 16 24.80
25	10°97'5	26°19'5	29.17	53.08	+1.69	+1.10	+0.05	24.09
28	10°77'0	25°95'9	29.85	52.36	+1.25	+1.10	+0.05	23.61
June 7	10°91'1	26°06'8	32.12	51.62	+ .38	+1.10	+0.05	24.27
11	11°20'7	26°26'8	33.06	49.39	+1.54	+1.10	+0.05	24.14
13	11°60'7	26°66'5	33.45	49.32	+1.20	+1.10	+0.05	24.12
18	11°55'1	26°65'2	34.04	50.32	—0.61	+1.10	+0.05	23.90
25	11°39'4	26°33'2	36.24	46.54	+1.38	+0.08	+0.04	24.28

GROUP II, PAIR 6.

Date.	Micrometer.		Mean app. Dec.	Corrections.				Latitude.
	<i>N.</i> <i>t. d.</i>	<i>S.</i> <i>t. d.</i>	<i>° ' "</i>	<i>Mic.</i> <i>' "</i>	<i>Level.</i> <i>" "</i>	<i>Ref.</i> <i>" "</i>	<i>Mer.</i> <i>" "</i>	<i>° ' "</i>
1892.								
May 22	12° 88' 4	23° 60' 0	21 12 17.18	+4 08.60	— .58	+ .07	+ .05	21 16 25.32
25	12° 74' 6	23° 29' 2	17.96	04.65	+ 1.85	+ .07	+ .05	24.58
28	12° 22' 8	22° 80' 8	18.65	05.44	+ .70	+ .07	+ .05	24.91
June 7	13° 49' 7	23° 95' 2	20.92	02.54	+ 1.08	+ .07	+ .05	24.66
11	13° 33' 3	23° 75' 1	21.88	01.68	+ 1.18	+ .07	+ .05	24.86
18	12° 85' 9	23° 32' 0	23.38	02.68	— 1.06	+ .07	+ .05	25.12
25	12° 75' 9	23° 09' 2	25.08	+3 59.71	+ .20	+ .03	+ .04	25.06

GROUP II, PAIR 7.

1892.								
May 22	22° 67' 1	13° 61' 3	21 19 57.05	—3 30.13	— 1.62	— .06	+ .06	21 16 25.30
25	22° 90' 6	13° 70' 5	57.84	33.45	+ .27	— .06	+ .06	24.66
28	23° 00' 9	13° 73' 9	58.54	35.05	+ .86	— .06	+ .06	24.35
June 7	23° 31' 7	14° 02' 1	60.82	35.65	— .31	— .06	+ .06	24.86
11	23° 35' 7	13° 97' 7	20 01.82	37.60	+ .53	— .06	+ .06	24.75
18	22° 39' 1	13° 07' 2	03.35	36.19	— 1.89	— .06	+ .06	25.27
25	23° 08' 6	13° 64' 1	05.11	39.11	— 1.04	— .06	+ .06	24.96

GROUP II, PAIR 8.

1892.								
May 22	15° 53' 4	20° 50' 1	21 14 30.50	+ 1 55.23	— 1.44	+ .03	+ .05	21 16 24.37
25	13° 79' 9	18° 63' 5	31.29	52.19	+ .74	+ .03	+ .05	24.30
28	12° 32' 1	17° 06' 4	32.01	50.03	+ 1.83	+ .03	+ .05	23.95
June 7	12° 69' 4	17° 39' 5	34.32	49.06	+ .22	+ .03	+ .05	23.68
11	12° 42' 9	17° 05' 2	35.32	47.25	+ .64	+ .03	+ .05	23.29
18	12° 58' 2	17° 30' 7	36.88	49.61	— 1.79	+ .03	+ .05	24.78
25	12° 93' 8	17° 45' 2	38.68	44.72	+ .40	+ .03	+ .05	23.88

From the preceding individual values, all those nights were chosen on which complete series were obtained. These complete nights were collated for each group, and the daily means taken as furnished by each group. This made it possible to reduce each pair to a mean declination system by subtracting each separate value of the latitude on any one night from the mean of all the pairs in the group for that night. Every night being treated in this way, and the mean being taken, we have a system of corrections which, being applied to their appropriate pairs, reduce the individual values of the group to one homogeneous system.

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

These reductions are given in the following tables:

Reduction to mean declination system.

GROUP I.

Date.	1.	2.	3.	4.	5.	6.	7.	8.	Sum.
1891.	"	"	"	"	"	"	"		"
June 7	—0.08	+0.09	+0.07	+0.13	—0.76	+0.39	+0.13		—0.03
8	+ .49	+ .15	— .04	+ .08	— .77	— .03	+ .11		— .01
11	+ .36	+ .92	— .52	— .36	— .86	+ .36	+ .12		+ .04
13	— .23	+ .03	+ .11	+ .09	— .69	+ .51	+ .17		— .01
17	— .16	+ .31	+ .27	— .33	— .47	+ .03	+ .36		+ .01
18	+ .58	+ .12	+ .32	— .65	— .57	+ .08	+ .10		— .02
22	— .37	+ .16	— .10	+ .06	— .40	+ .24	+ .42		+ .01
26	+ .14	+ .28	+ .14	— .22	— .55	— .02	+ .24		+ .01
1892.									
Apr. 9	— .56	+ .45	— .06	+ .04	— .68	+ .22	+ .60		+ .01
19	— .20	+ .50	+ .03	— .12	— .72	+ .32	+ .16		— .03
24	— .40	— .01	+ .16	— .04	— .56	+ .31	+ .53		— .01
May 4	+ .47	+ .17	— .19	— .00	— .23	— .25	+ .06		+ .03
5	— .30	+ .45	— .09	— .05	— .51	— .01	+ .48		— .03
9	— .15	+ .53	+ .03	+ .12	— .65	— .13	+ .24		— .01
13	— .21	— .36	+ .41	+ .12	— .42	— .01	+ .45		— .02
14	— .07	— .11	— .06	— .06	— .19	+ .15	+ .35		+ .01
15	— .47	+ .08	+ .19	+ .10	— .18	— .23	+ .50		— .01
18	— .50	+ .16	— .00	+ .04	— .16	+ .12	+ .30		— .04
21	— .06	+ .08	+ .13	— .20	— .10	— .03	+ .17		— .01
22	— .24	— .01	— .29	+ .64	— .25	+ .13	+ .02		— .00
24	— .17	+ .58	— .14	+ .03	— .61	+ .07	+ .25		+ .01
25	— .10	+ .13	+ .22	— .22	— .45	— .14	+ .57		+ .01
26	+ .22	— .15	+ .14	+ .10	— .40	— .03	+ .15		+ .03
28	— .02	+ .50	+ .05	— .10	— .70	+ .05	+ .24		+ .02
29	— .36	— .02	— .06	+ .32	— .40	+ .12	+ .40		— .00
June 3	+ .14	— .33	+ .26	+ .19	— .32	— .00	+ .08		+ .02
4	— .24	+ .02	+ .21	— .28	— .24	— .03	+ .52		— .04
5	— .10	+ .58	— .20	— .24	— .52	+ .01	+ .49		+ .02
11	— .50	+ .30	+ .08	+ .76	— .64	— .08	+ .05		— .03
13	+ .58	+ .15	— .41	— .28	— .20	+ .07	+ .11		+ .02
17	— .01	+ .16	+ .13	— .44	— .49	+ .41	+ .23		— .01
18	— .44	+ .03	— .06	+ .15	— .46	+ .04	+ .72		— .02
22	— .19	+ .18	+ .55	— .04	— .66	— .29	+ .44		— .01
24	— .25	+ .65	+ .15	— .53	— .49	— .46	+ .95		+ .02
25	— .21	+ .24	+ .27	— .30	— .67	— .25	+ .89		— .03
Means	— .103	+ .200	+ .049	— .043	— .485	+ .047	+ .331		— .004

Reduction to mean declination system.

GROUP II.

Date.	1.	2.	3.	4.	5.	6.	7.	8.	Sum.
1891.	"	"	"	"	"	"	"	"	"
June 18	-0.25	-0.00	-0.30	+0.44	+0.18	-0.52	-0.16	+0.58	-0.03
26	+ .30	- .17	- .19	+ .69	- .24	- .58	- .04	+ .21	- .02
27	- .09	+ .41	- .29	+ .09	+ .17	- .53	- .33	+ .60	+ .03
28	- .47	+ .25	+ .03	+ .19	- .26	- 1.02	+ .41	+ .90	+ .03
30	- .63	+ .54	- .13	+ .69	+ .13	- .81	- .09	+ .32	+ .02
July 18	- .43	+ .71	- .60	+ .87	- .04	- .36	- .37	+ .25	+ .03
26	- .86	+ .26	- .38	+ .46	+ .10	- .42	- .16	+ 1.00	.00
29	+ .34	+ .45	- .10	+ .30	+ .18	- .94	- .56	+ .34	+ .01
Aug. 5	- .56	+ .51	- .18	+ .39	+ .06	- .96	+ .12	+ .64	+ .02
6	- .21	- .23	- .49	+ .89	+ .43	- .09	- .54	+ .25	+ .01
10	- .41	+ .27	- .37	+ .19	+ .25	- .52	+ .11	+ .46	- .02
13	- .27	+ .36	- .18	+ .64	+ .24	- .88	+ .12	- .06	- .03
14	- .53	+ .35	- .45	+ .73	+ .37	- .55	- .04	+ .09	- .03
16	- .57	+ .69	- .07	+ .17	+ .11	- .88	- .05	+ .60	.00
1892.									
May 22	+ .01	+ .48	- .50	+ .33	+ .07	- .45	- .43	+ .50	+ .01
25	+ .70	+ .21	- .90	+ .25	+ .25	- .24	- .32	+ .04	- .01
28	+ .03	+ .16	- .88	+ .34	+ .69	- .61	- .05	+ .35	+ .03
June 7	+ .19	+ .30	- .89	+ .11	+ .16	- .23	- .43	+ .75	+ .04
11	+ .60	+ .05	- .51	+ .45	- .03	- .75	- .64	+ .82	- .01
18	+ .23	+ .41	- .69	+ .31	+ .80	- .42	- .57	- .08	- .01
25	+ .34	+ .47	- .69	+ .35	+ .15	- .63	- .53	+ .55	+ .01
Means	- .121	+ .309	- .417	+ .423	+ .180	- .590	- .217	+ .434	

GROUP III.

Date.	1.	2.	3.	4.	5.	6.	7.	8.	Sum.
1891.	"	"	"	"	"	"	"	"	"
July 8	-0.19	+0.32	-0.35	-0.85	+0.95	-0.03	-0.19	+0.33	-0.01
17	- .41	+ .09	+ .45	- .27	+ .61	- .49	+ .07	- .07	- .02
18	- .44	- .09	- .40	- .78	+ .82	+ .04	+ .72	+ .11	- .02
23	- .34	- .43	- .75	- .49	+ .80	+ .11	+ .52	+ .56	- .02
26	- .21	+ .37	- .77	- .19	+ .83	- .71	+ .40	+ .27	- .01
27	- .19	+ .05	- .03	- .43	+ .31	- .05	+ .52	- .15	+ .03
Aug. 5	- .42	+ .36	- .60	- .18	+ .80	- .26	+ .20	+ .07	- .03
13	+ .23	+ .19	- .05	- .41	+ .79	- .53	+ .13	- .34	+ .01
14	- .58	+ .39	- .25	- .14	+ .28	- .32	+ .60	+ .02	.00
15	+ .03	+ .39	- .41	- .54	+ .59	+ .16	+ .47	- .67	+ .02
16	- .19	- .05	- .29	- .15	+ .40	- .27	+ .66	- .09	+ .02
26	- .55	- .01	- .02	+ .07	+ .50	- .15	+ .49	- .35	- .02
29	- .03	- .24	- .19	+ .50	- .24	+ .09	+ .53	- .39	+ .03
Sept. 2	- .84	- .10	+ .30	- .12	+ .10	+ .07	+ .96	- .38	- .01
9	- .06	- .27	- .01	- .08	- .15	+ .30	+ .52	- .24	+ .01
18	- .51	- .22	+ .18	+ .24	+ .20	+ .02	+ .28	- .18	+ .01
19	- .60	- .04	- .20	+ .38	+ .42	+ .29	+ .33	- .56	+ .02
26	- .80	+ .18	+ .23	+ .25	+ .55	- .28	+ .03	- .12	+ .04
28	- .33	.00	+ .06	- .24	+ .10	+ .14	+ .36	- .12	- .03
Means	- .338	+ .047	- .163	- .181	+ .456	- .098	+ .400	- .120	

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

Reductions to mean declination system.

GROUP IV.

Date.	1.	2.	3.	4.	5.	6.	7.	8.	Sum.
1891.	"	"	"	"	"	"	"	"	"
Aug. 20	-0.24	+0.74	+1.17	-0.19	-0.70	-0.09	-0.26	-0.47	-0.04
23	-0.70	+0.87	+0.50	-0.26	-0.66	+0.16	-0.29	+0.39	+0.01
25	-0.63	+0.22	+1.40	+0.04	-0.50	-0.06	-0.77	+0.29	-0.01
29	-0.00	+0.29	+1.13	-0.41	-0.76	+0.08	-0.58	+0.22	-0.03
Sept. 2	-0.52	+0.52	+0.94	-0.01	-0.90	+0.36	-0.68	+0.32	+0.03
9	-0.77	+0.33	+1.59	-0.08	-0.78	+0.11	-0.81	+0.40	-0.01
12	-0.46	+0.76	+1.06	-0.22	-1.02	-0.04	-0.24	+0.16	-0.00
15	-0.40	+0.35	+0.77	-0.13	-0.43	+0.07	-0.65	+0.42	-0.00
23	-0.18	+0.79	+1.23	-0.18	-0.49	-0.25	-0.69	-0.21	+0.02
26	-0.46	+0.10	+0.64	-0.19	-0.37	+0.30	-0.53	+0.49	-0.02
28	-0.31	+0.27	+0.76	+0.09	-0.93	+0.69	-0.75	+0.21	+0.03
Oct. 4	-0.26	+0.53	+0.58	-0.04	-0.94	+0.37	-0.42	+0.17	-0.01
5	-0.34	+0.64	+1.14	-0.06	-0.84	-0.35	-0.46	+0.24	-0.04
8	-0.23	+0.16	+0.86	+0.06	-0.69	+0.35	-0.74	+0.22	-0.01
28	-0.68	+0.88	-0.07	-0.28	-1.20	+1.03	-0.00	+0.32	-0.00
30	-0.49	+0.23	+0.71	-0.25	-0.51	+0.17	-0.51	+0.63	-0.02
31	-0.20	-0.04	+0.99	-0.15	-0.41	+0.27	-0.19	-0.30	-0.03
Nov. 1	-0.32	+0.17	+1.05	+0.08	-0.79	+0.39	-0.80	+0.24	+0.02
4	-0.37	+0.27	+0.53	-0.09	-0.53	+0.51	-0.99	+0.63	-0.04
6	-0.47	+0.73	+0.84	-0.64	-0.38	+0.30	-0.64	+0.26	-0.00
14	+0.01	-0.31	+0.52	+0.45	-0.55	-0.03	-0.58	+0.45	-0.04
17	-0.38	+0.22	+0.83	+0.04	-0.81	+0.58	-0.57	+0.08	-0.01
Means	-0.382	+0.396	+0.871	-0.110	-0.690	+0.224	-0.552	+0.235	

GROUP V.

1891.	"	"	"	"	"	"	"	"	"
Oct. 4	0.00	-0.12	-0.58	+0.13	+0.50	+0.26	-0.13	-0.06	0.00
5	+0.19	+0.11	-0.67	+0.25	+0.31	+0.30	-0.53	0.00	-0.04
8	-0.10	-0.23	-0.44	-0.02	+0.18	+0.24	-0.22	+0.55	-0.04
30	+0.74	+0.03	-1.18	+0.34	-0.13	+0.61	-0.65	+0.29	-0.01
31	-0.12	-0.28	-0.61	+0.32	+0.04	+0.66	-0.46	+0.43	-0.02
Nov. 1	+0.31	-0.09	-0.75	-0.59	+0.19	+0.51	+0.13	+0.31	+0.02
6	+0.02	+0.27	-0.63	-0.08	+0.26	+0.69	-0.57	+0.07	+0.03
14	+0.16	+0.20	-0.77	-0.01	+0.19	+0.40	-0.48	+0.30	-0.01
17	-0.10	+0.37	-0.61	+0.09	+0.04	+0.35	+0.01	-0.17	-0.02
19	+0.10	+0.21	-0.63	+0.10	+0.03	+0.25	-0.27	+0.21	-0.00
21	-0.34	+0.36	-0.61	-0.10	-0.15	+0.42	+0.29	+0.10	-0.03
23	+0.31	+0.36	-1.15	+0.35	-0.05	+0.29	-0.01	-0.14	-0.04
Dec. 10	+0.05	+0.06	-0.58	+0.32	+0.33	+0.26	+0.03	+0.14	-0.03
12	+0.36	+0.53	-1.10	-0.14	+0.04	+0.62	-0.16	-0.16	-0.01
15	0.00	+0.30	-1.06	+0.12	+0.17	+0.34	-0.18	+0.28	-0.03
21	-0.22	+0.13	-0.57	+0.48	+0.28	-0.03	-0.32	+0.27	+0.02
23	+0.51	-0.03	-1.05	+0.33	+0.65	-0.11	-0.23	-0.05	+0.02
25	+0.31	+0.09	-0.85	+0.31	-0.17	+0.42	-0.40	+0.28	-0.01
26	+0.21	+0.11	-0.93	-0.03	0.00	+0.72	+0.20	-0.16	+0.02
29	+0.14	+0.57	-0.62	-0.22	-0.22	+0.51	+0.13	-0.27	+0.02
30	+0.35	+0.17	-0.57	-0.40	+0.78	+0.02	-0.49	+0.10	-0.04
Means	+0.137	+0.146	-0.760	+0.043	+0.156	+0.368	-0.205	+0.110	

Reductions to mean declination system.

GROUP VI.

Date.	1.	2.	3.	4.	5.	6.	7.	8.	Sum.
1891.	"	"	"	"	"	"	"	"	"
Nov. 21	-1'20	-0'26	+0'54	+0'18	+0'02	-0'00	+0'53	+0'20	+0'01
Dec. 12	-25	+55	-26	+15	+59	-58	+17	-39	-02
15	-81	+60	+60	-01	+04	-24	+19	-38	-01
23	-47	+91	+11	+20	+77	-30	-56	-68	-02
26	-18	+42	+40	+46	+26	-76	+21	-78	+03
29	-99	+35	+17	+37	-27	-15	+50	+01	-01
1892.									
Jan. 5	-82	+18	+60	+09	+19	-10	+52	-66	00
6	-12	+62	+18	+58	-17	-62	-10	-40	-03
12	-97	+55	-17	+06	+09	-40	+54	+32	+02
18	-67	+37	+20	+11	+09	-51	+36	+01	-04
20	-42	+84	+42	-03	+31	-58	-18	-35	+01
21	-55	-09	+44	-05	+38	-36	-13	+33	-03
24	-99	+12	+05	+39	+37	-26	+16	+14	-02
27	-67	+11	+39	+54	-09	-22	+30	-38	-02
Feb. 3	-92	+18	+19	+58	+16	-19	+10	-10	00
6	-46	+06	+12	+05	+14	-52	+50	+14	+03
8	-1'17	-07	+21	+77	+04	+39	+08	-27	-02
12	-1'01	-17	+50	+50	+93	-42	-03	-29	+01
13	-64	+48	+39	+17	+10	-67	+45	-32	-04
Means	-701	+303	+267	+269	+208	-342	+190	-203	

GROUP VII.

Date.	1.	2.	3.	4.	5.	6.	7.	8.	Sum.
1891.	"	"	"	"	"	"	"	"	"
Dec. 29	-0'60	+0'10	+0'02	+0'02	+0'45	-0'32	+0'32	+0'02	+0'01
1892.									
Jan. 5	-77	-16	+06	+17	+1'04	-82	+16	+35	+03
11	-83	+27	-05	+61	+79	-35	-23	-25	-04
20	-30	-08	-39	+74	+64	-64	-18	+17	-04
24	-69	-07	-17	+30	+84	-32	-17	+27	-01
Feb. 2	-65	-12	+28	+05	+79	-25	-37	+30	+03
3	-29	-42	-07	+43	+85	-27	-21	-03	-01
4	-83	+03	-06	+45	+57	-14	+02	-04	00
8	-08	-04	-22	-15	+90	-75	+30	+03	-01
12	+16	-22	-42	-30	+1'01	-45	-02	+26	+02
13	-42	-49	+11	+31	+62	-58	+11	+35	+01
24	-19	-05	+10	-09	+63	-39	-17	+16	00
27	-49	-12	-06	-19	+89	-05	-07	+05	-04
28	-02	+03	-08	-04	+70	-53	-19	+11	-02
29	-56	+16	-14	+16	+1'03	-42	+03	-28	-02
Mar. 1	-24	-28	+07	+07	+70	-66	+15	+17	-02
2	-39	+12	-29	+31	+75	-78	+14	+13	-01
5	-38	+29	-23	+10	+64	-54	+10	+02	00
9	+47	-55	-30	+33	+75	-73	-08	+14	+03
10	-89	+45	-02	+14	+87	-26	-24	-07	-02
13	-31	-23	+37	+31	-01	-75	+39	+21	-02
16	-31	+01	-19	-04	+81	-69	+27	+14	00
24	-74	+31	+11	+20	+56	-54	-29	+36	-03
Means	-406	-046	-068	+169	+731	-488	-010	+112	

*Results from observations for the variation of latitude at Waikiki,
Hawaiian Islands.*

Reductions to mean declination system.

GROUP VIII.

Date.	1.	2.	3.	4.	5.	6.	7.	8.	Sum.
1892.	"	"	"	"	"	"	"	"	"
Feb. 3	+0.63	+0.31	-0.46	-0.04	-0.59	+0.61	-0.12	-0.36	-0.02
12	+0.41	+0.22	-0.60	+0.03	-0.29	+0.18	+0.10	-0.04	+0.01
27	+0.44	+0.24	-0.30	-0.47	-0.20	+0.61	+0.33	-0.63	+0.02
28	+0.15	+0.01	-0.52	+0.07	-0.29	+0.21	+0.25	+0.13	+0.01
Mar. 2	-0.14	-0.01	-0.19	+0.39	-0.33	+0.22	-0.36	+0.44	+0.02
5	+0.17	+0.27	-0.50	+0.03	+0.25	+0.05	-0.26	-0.03	-0.02
9	+0.07	+0.21	-0.69	-0.35	-0.17	+0.59	+0.15	+0.20	+0.01
10	+0.34	-0.02	-0.72	+0.07	+0.30	-0.08	-0.46	+0.60	+0.03
23	+0.03	+0.69	-0.51	-0.05	-0.17	+0.22	+0.07	-0.27	+0.01
24	+0.01	-0.14	-0.37	-0.04	-0.05	0.00	+0.26	+0.29	-0.04
29	-0.24	+0.18	-0.71	-0.16	+0.35	-0.04	-0.04	+0.66	0.00
30	-0.08	+0.25	-0.43	-0.20	+0.35	+0.35	+0.09	-0.32	+0.01
31	+0.05	+0.15	-0.74	+0.01	-0.39	+0.35	+0.43	+0.13	-0.01
Apr. 9	-0.41	+0.18	-0.37	-0.08	-0.20	+0.26	+0.21	+0.37	-0.04
19	+0.25	-0.23	-0.66	-0.13	+0.30	+0.34	+0.10	0.00	-0.03
24	-0.06	+0.18	-0.26	+0.22	-0.09	+0.28	-0.34	+0.07	0.00
May 2	-0.10	-0.27	+0.23	-0.19	+0.09	+0.33	-0.12	+0.05	+0.02
5	+0.37	+0.15	-0.64	-0.41	-0.15	+0.59	-0.09	+0.21	+0.03
Means	+0.111	+0.132	-0.469	-0.072	-0.071	+0.282	+0.011	+0.083	

The preceding tables give the following summary:

Reductions to mean declination system.

Group.	Pair—							
	1.	2.	3.	4.	5.	6.	7.	8.
	"	"	"	"	"	"	"	"
I	-0.10	+0.20	+0.05	-0.04	-0.48	+0.05	+0.33	
II	-0.12	+0.31	-0.42	+0.42	+0.18	-0.59	-0.22	+0.43
III	-0.34	+0.05	-0.16	-0.18	+0.46	-0.10	+0.40	-0.12
IV	-0.38	+0.40	+0.87	-0.11	-0.69	+0.22	-0.55	+0.24
V	+0.14	+0.15	-0.76	+0.04	+0.16	+0.37	-0.20	+0.11
VI	-0.70	+0.30	+0.27	+0.27	+0.21	-0.34	+0.19	-0.20
VII	-0.41	-0.05	-0.07	+0.17	+0.73	-0.49	-0.01	+0.11
VIII	+0.11	+0.13	-0.47	-0.07	-0.07	+0.28	+0.01	+0.08

The foregoing mean corrections being applied to the individual values for each day, and the daily means being taken, we have the following reduced values for each group and date of observation:

Corrected daily means.

Date.	Group I.	No. of pairs.	Group II.	No. of pairs.	Group III.	No. of pairs.	Date.	Group I.	No. of pairs.	Group II.	No. of pairs.	Group III.	No. of pairs.
1891.	"		"		"		1891.	"		"		"	
June 6	4:20	6					June 27	4:35	6	4:43	8		
7	4:59	7					28	4:70	6	4:23	8		
8	4:33	6					30	4:54	6	4:45	8		
9	4:52	6					July 4			4:22	7	4:21	7
10	4:37	6	4:26	5			7			4:73	3		
11	4:50	7	4:29	4			8			4:24	7	4:41	8
12	4:43	5					17			4:08	5	4:09	8
13	4:59	7	4:56	7			18			4:05	8	4:20	8
15	4:35	6	4:14	1			22			4:32	6	4:26	5
16	4:68	6					23			4:24	5	4:34	8
17	4:59	7	4:54	7			24			4:08	4	4:43	1
18	4:70	7	4:60	8			25			3:75	2		
19	4:23	6	4:56	6			26			4:22	8	4:17	8
22	4:44	7	4:45	7			27			4:32	7	4:05	8
24	4:47	6	4:45	4			29			4:04	8	3:91	4
25	4:62	2					30			4:12	2	4:27	7
26	4:40	7	4:56	8			31			3:93	3	4:23	2

Date.	Group II.	No. of pairs.	Group III.	No. of pairs.	Group IV.	No. of pairs.	Date.	Group II.	No. of pairs.	Group III.	No. of pairs.	Group IV.	No. of pairs.
1891.	"		"		"		1891.	"		"		"	
Aug. 2	4:24	7	4:21	7			Aug. 25			4:34	7	4:02	8
3	4:20	7	4:26	6			26			4:21	8		
4	4:08	7					29			4:03	8	3:66	8
5	4:16	8	4:12	8			31			4:24	7	4:19	7
6	4:11	8	4:23	5			Sept. 2			4:06	8	4:14	8
7	3:99	7	4:21	7			6			4:20	6	4:12	7
10	4:15	8	4:12	7			9			4:24	8	3:89	8
11	4:28	2					12			4:00	7	3:88	8
12	3:87	1					15			4:09	6	3:79	8
13	4:02	8	4:07	8			18			4:08	8		
14	4:03	8	3:78	8			19			4:10	8	3:73	7
15	4:02	7	4:21	8			23			3:87	3	3:63	8
16	3:99	8	4:19	8			26			4:08	8	3:81	8
20			4:10	7	3:94	8	27			3:98	7	3:76	7
22			4:21	7	3:80	2	28			4:18	8	3:65	8
23			4:14	7	4:10	8							

Date.	Group IV.	No. of pairs.	Group V.	No. of pairs.	Group VI.	No. of pairs.	Date.	Group IV.	No. of pairs.	Group V.	No. of pairs.	Group VI.	No. of pairs.
1891.	"		"		"		1891.	"		"		"	
Oct. 4	4:06	8	3:92	8			Nov. 13	4:09	4	4:07	7		
5	3:84	8	4:01	8			14	3:92	8	4:08	8		
8	3:86	8	4:04	8			15	3:63	2				
10	4:00	6					16	3:20	1				
14	3:79	2					17	4:02	8	4:16	8		
16	3:72	7	3:98	7			19			4:07	8	3:94	7
17	3:56	2					21			4:10	8	4:12	8
22	3:83	6	4:06	1			23			4:15	8		
28	3:86	8	3:94	3			30			3:89	7	4:00	7
30	4:19	8	4:01	8			Dec. 1			4:07	3	4:07	7
31	3:92	8	3:96	8			5			3:87	5	3:91	7
Nov. 1	3:91	8	3:99	8			6			3:99	6		
4	3:82	8	3:99	7			9			4:31	7	3:98	7
6	4:04	8	4:03	8			10			4:28	8	4:18	3
7	3:54	7					12			4:30	8	4:15	8
10	3:48	4					13			4:13	3		
12	3:60	5	4:22	2									

Corrected daily means.

Date.	Group VIII.	No. of pairs.	Group I.	No. of pairs.	Group II.	No. of pairs.	Date.	Group VIII.	No. of pairs.	Group I.	No. of pairs.	Group II.	No. of pairs.
1892.	"		"		"		1892.	"		"		"	
Apr. 9	4.98	8	4.76	7			May 2	4.75	8				
10	5.25	1					4	4.48	7	4.69	7		
13	4.42	2					5	4.71	8	4.77	7		
14	4.83	5					6	4.83	4				
15	4.48	3					7	4.99	1				
16	4.38	5	4.78	4			9	4.78	5	4.41	7		
17	4.44	5					10	4.72	5	4.52	2		
18	4.81	5					11	4.65	5				
19	4.68	8	4.68	7			13			4.43	7		
20	4.83	4					14	4.63	6	4.45	7		
21	4.80	5					15	4.69	5	4.40	7		
23	4.84	6	4.71	6			18	4.72	6	4.80	7		
24	4.66	8	4.72	7			21			4.80	7		
25	4.84	7	4.67	6			22	4.68	5	4.79	7	4.87	8
29	4.45	3					23	4.81	5	4.73	6		
May 1	4.69	4	4.60	6									

Date.	Group I.	No. of pairs.	Group II.	No. of pairs.	Date.	Group I.	No. of pairs.	Group II.	No. of pairs.
1892.	"		"		1892.	"		"	
May 24	4.61	7			June 11	4.40	7	4.11	8
25	4.60	7	4.34	8	12	4.66	3		
26	4.56	7			13	4.65	7	4.68	5
27	4.40	5			14	4.51	5	4.28	2
28	4.62	7	4.30	8	17	4.61	7	4.89	1
29	4.74	7			18	4.74	7	4.70	8
30	4.43	1			19	5.04	1		
June 3	4.66	7			22	4.46	7		
4	4.66	7			23			3.67	1
5	4.72	7			24	4.27	7		
6	4.62	1			25	4.53	7	4.43	8
7	4.45	6	4.44	8					

In order now to connect the groups and reduce each one to the first taken as a basis of comparison, the weighted means are taken for those parts of the preceding table which overlap, and we thus get the following group connections with their respective weights. The numbers of pairs indicate the weight, and are placed to the right of the quantities to which they apply.

GROUPS—								
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	II.
4'50 (97)	4'45 (81) 4'13 (161)	4'17 (146) 4'13 (128)	3'88 (118) 3'87 (134)	4'02 (99) 4'13 (158) 4'24 (26)	4'09 (119) 4'21 (176) 4'25 (82)	4'22 (16) 4'38 (145) 4'63 (221)	4'47 (37) 4'68 (161) 4'71 (149) 4'74 (10)	4'65 (114) 4'59 (140) 4'87 (8) 4'46 (65)

From the above group connections the following conditional equations arise:

[illegible]

Where \mathbf{v} is correction to be applied to the connection between Group II and Group I,

and so on

The correlative equations are—

v	k ₁	k ₂	k ₃	k ₄	k ₅	$\frac{I}{p}$
2.1	+1	+1				0.226
3.2	+1					.131
4.3	+1					.163
5.4	+1					.175
6.5	+1		+1			.147
7.6	+1		+1	+1		.126
8.7	+1			+1		.107
1.8	+1				+1	.155
2.1		-1				.225
7.5			-1			1.010
8.6				-1		.392
2.8					-1	2.250

From which the following normal equations are derived:

k ₁	k ₂	k ₃	k ₄	k ₅	
+1.23	+0.23 +0.45	+0.27 .00 +1.28	+0.23 .00 + .13 + .62	+0.38 +0.23 .00 .00 +2.63	// =+.01 =+.08 =+.15 =.00 =-.32

The solution gives—

$$\begin{aligned} k_1 &= -0.0193 \\ k_2 &= +.257 \\ k_3 &= +.119 \\ k_4 &= -.0192 \\ k_5 &= -.140 \end{aligned}$$

The adjustment of the outstanding differences brings out the following equations:

$$\begin{array}{ll} \text{II} - \text{I} = -.05 \text{ (1891)} & \text{II} - \text{I} = -.13 \text{ (1892)} \\ \text{III} - \text{II} = +.04 & \\ \text{IV} - \text{III} = -.25 & \text{VII} - \text{V} = -.02 \\ \text{V} - \text{IV} = +.15 & \\ \text{VI} - \text{V} = -.04 & \text{VIII} - \text{VI} = +.22 \\ \text{VII} - \text{VI} = +.17 & \\ \text{VIII} - \text{VII} = +.05 & \text{II} - \text{VIII} = +.13 \\ \text{I} - \text{VIII} = -.06 & \\ \Sigma & = +.01 \end{array}$$

The error of closing may result from errors of observation or from a slight error in the constant of aberration. If the accepted constant (20''.445) is too small, as seems to be indicated by other observations, then there must have been some compensation in the observing, because the outstanding error, +.01, is practically insignificant.

As several determinations of the constant of aberration give a value not far from 20''.50, it is worth while to see what effect this value would

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have if introduced in the computation of the apparent places of the stars.

To this end all those values of the terms involving the constant of aberration for the dates of observation common to two successive groups were tabulated. Taking a mean for the two stars of each pair and the difference between the corresponding pairs of successive groups, the final mean values gave the following effect of those terms on the group connections:

I	II	III	IV	V	VI	VII	VIII	I	II
4''·5	3''·6	4''·3	4''·0	4''·9	4''·5	4''·3	3''·5	5''·2	

Had we used a value of 20''·50 in the reduction of the star places the effect on the group connections would have been—

$\frac{d A}{A}$ multiplied by the above numbers, or $\frac{·055}{20·45} \times 4''·5$, etc., as follows:

I	II	III	IV	V	VI	VII	VIII	I	II
''·012	''·010	''·012	''·011	''·013	''·012	''·012	''·009	''·014	

The sum of these is +''·10, so that if we accept the supposed value of the aberration constant there would remain an outstanding error of +''·11 from observation arising from the uncertainty of the group connections. If we admit a certain compensation in the errors of observation then the above investigation would rather confirm the value 20''·445, or at least indicate that it should not be changed more than one or two hundredths.

The values of k_1 , k_2 , k_3 , k_4 , and k_5 , being substituted in the correlatives, give the following values for V:

V	''	V	''
2·1 =	+·022	8·7 =	-·004
3·2 =	-·003	1·8 =	-·025
4·3 =	-·003	(2·1) =	-·058
5·4 =	-·003	7·5 =	-·120
6·5 =	+·015	8·6 =	+·008
7·6 =	+·010	2·8 =	+·314

and the corrected reductions between the groups are—

R	+	-
	''	''
2·1	0·072	
3·2		0·043
4·3	·247	
5·4		·153
6·5	·055	
7·6		·160
8·7		·054
1·8	·035	
Sum	0·409	0·410

The final corrections therefore to reduce the different groups to one homogeneous system are—

$$\begin{array}{ll} \text{I} = 0.00 & \text{V} = +0.12 \\ \text{II} = +0.07 & \text{VI} = +0.18 \\ \text{III} = +0.03 & \text{VII} = +0.02 \\ \text{IV} = +0.28 & \text{VIII} = -0.04 \end{array}$$

Applying these to the daily means of the groups, each one of which has been reduced to its own mean declination system, we get the following table. Each individual value is introduced with its appropriate weight.

Date.	Lat.	Pairs.	Date.	Lat.	Pairs.	Date.	Lat.	Pairs.
1891.	//		1891.	//		1891.	//	
June 6	4°20	6	Aug. 20	4°18	15	Dec. 10	4°39	11
7	4°59	7	22	4°20	9	12	4°38	14
8	4°33	7	23	4°28	15	13	4°25	3
9	4°52	6	25	4°33	15	15	4°17	16
10	4°35	11	26	4°24	8	17	4°33	5
11	4°45	11	29	4°00	16	19	4°32	11
12	4°43	5	31	4°37	14	21	4°24	8
13	4°61	14	Sept. 2	4°26	16	23	4°36	16
15	4°33	7	6	4°32	13	24	4°06	8
16	4°68	6	9	4°22	16	25	4°31	13
17	4°60	14	12	4°10	15	26	4°36	16
18	4°68	15	15	4°09	14	27	3°71	2
19	4°43	12	18	4°11	8	28	4°41	8
22	4°48	14	19	4°07	15	29	4°38	24
24	4°49	10	23	3°91	11	30	4°23	15
25	4°62	2	26	4°10	16	1892.		
26	4°52	15	27	4°03	14	Jan. 1	3°99	2
27	4°44	14	28	4°07	16	2	4°81	1
28	4°47	14	Oct. 4	4°19	16	5	4°22	23
30	4°53	14	5	4°13	16	6	3°99	15
July 4	4°27	14	8	4°15	16	10	4°24	8
7	4°80	3	10	4°28	6	11	4°31	14
8	4°38	15	14	4°07	2	12	4°46	13
17	4°13	13	16	4°05	14	15	4°51	3
18	4°18	16	17	3°84	2	16	4°12	2
22	4°34	11	22	4°12	7	18	4°52	12
23	4°35	13	28	4°12	11	19	4°06	5
24	4°21	5	30	4°30	16	20	4°18	16
25	3°82	2	31	4°14	16	21	4°21	13
26	4°25	16	Nov. 1	4°15	16	23	4°35	14
27	4°23	15	4	4°10	15	24	4°29	16
29	4°05	12	6	4°24	16	25	4°41	14
30	4°28	9	7	3°82	7	27	4°73	14
31	4°10	5	10	3°76	4	Feb. 2	4°58	9
Aug. 2	4°28	14	12	4°01	7	3	4°43	24
3	4°28	13	13	4°26	11	4	4°51	15
4	4°15	7	14	4°20	16	6	4°37	13
5	4°19	16	15	3°91	2	8	4°39	23
6	4°21	13	16	3°48	1	11	4°43	3
7	4°15	14	17	4°29	16	12	4°47	24
10	4°19	15	19	4°16	15	13	4°31	16
11	4°35	2	21	4°26	16	14	4°47	7
12	3°94	1	23	4°27	8	19	4°38	6
13	4°10	16	30	4°10	14	20	4°48	13
14	3°96	16	Dec. 1	4°23	10	21	4°58	18
15	4°17	15	5	4°05	12	22	4°52	7
16	4°14	16	6	4°11	6	23	4°51	21
			9	4°30	14	24	4°75	8

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Date.	Lat.	Pairs.	Date.	Lat.	Pairs.	Date.	Lat.	Pairs.
1892.	"		1892.	"		1892.	"	
Feb. 26	4°69	5	Apr. 14	4°79	5	May 22	4°81	20
27	4°60	16	15	4°44	3	23	4°75	11
28	4°65	16	16	4°54	9	24	4°61	7
29	4°68	15	17	4°40	5	25	4°50	15
Mar. 1	4°72	8	18	4°77	5	26	4°56	7
2	4°68	16	19	4°66	15	27	4°40	5
4	4°87	7	20	4°79	4	28	4°49	15
5	4°96	16	21	4°76	5	29	4°74	7
8	4°74	7	23	4°76	12	30	4°43	1
9	4°57	16	24	4°67	15	June 3	4°66	7
10	4°67	16	25	4°74	13	4	4°66	7
13	4°56	15	29	4°41	3	5	4°72	7
14	4°77	9	May 1	4°62	10	6	4°62	1
16	4°66	9	2	4°71	8	7	4°48	14
19	4°74	5	4	4°57	14	11	4°28	15
20	4°70	6	5	4°72	15	12	4°66	3
21	4°83	13	6	4°79	4	13	4°69	12
23	4°71	8	7	4°95	1	14	4°46	7
24	4°77	16	9	4°55	12	17	4°65	8
29	4°70	14	10	4°63	7	18	4°76	15
30	4°81	12	11	4°61	5	19	5°04	1
31	4°77	15	13	4°43	7	22	4°46	7
Apr. 6	4°66	6	14	4°51	13	23	3°74	1
9	4°86	15	15	4°50	12	24	4°27	7
10	5°21	1	18	4°74	13	25	4°51	15
13	4°38	2	21	4°80	7			

These being collected for short intervals in such a way as to give about equal weights for each period as regards nights and pairs, we have the following table for the variation of the latitude of Waikiki from June 8, 1891, to June 21, 1892.

From the preceding method of reduction it will be seen that these values, as far as concerns the changes of latitude, are entirely free from errors of declination.

Date.	Lat.	Prs.	Nts.	Date.	Lat.	Prs.	Nts.	Date.	Lat.	Prs.	Nts.
1891.	"			1891.	"			1892.	"		
June 8	4°41	48	6	Oct. 24	4°17	52	5	Feb. 25	4°59	57	5
14	4°55	46	5	Nov. 3	4°16	47	3	29	4°68	55	4
21	4°53	51	4	10	4°09	45	5	Mar. 7	4°78	46	4
27	4°48	45	4	18	4°21	50	5	12	4°65	40	3
July 8	4°36	59	5	30	4°14	50	5	20	4°74	41	5
21	4°28	40	3	Dec. 13	4°30	58	5	27	4°76	42	3
26	4°21	38	4	21	4°28	61	6	Apr. 7	4°76	47	7
Aug. 1	4°21	53	5	27	4°35	50	4	18	4°64	43	6
6	4°18	50	4	1892.				26	4°70	43	4
12	4°09	50	5	Jan. 2	4°23	41	4	May 3	4°65	47	4
18	4°16	46	3	11	4°25	55	6	10	4°57	49	7
24	4°27	47	4	20	4°26	46	4	18	4°72	52	4
Sept. 2	4°23	59	4	24	4°35	44	3	25	4°58	45	5
13	4°14	53	4	31	4°55	47	3	June 2	4°62	45	7
23	4°04	56	4	Feb. 6	4°42	51	3	11	4°48	51	5
Oct. 1	4°13	48	3	12	4°41	43	3	21	4°56	54	7
12	4°13	38	4	18	4°51	44	4				

The preceding values are shown graphically in illustration No. 15.

It is evident that a sine curve follows in a general way the law of the variation of the latitude. Coefficients for this equation were first determined assuming a period of 415 days for the complete revolution of the axis of rotation about that of the earth's figure. This brought out the fact that the period chosen was entirely too long, and, moreover, that a second-periodic term, depending on the cosine, would materially improve the agreement between the empirical formula and the actual observations. This change being made, revealed the necessity of another slight change in the period, and one of 378 days was used.

The equation of the curve is:

$$\varphi = \varphi_0 - 0''.311 \sin. n t + 0''.037 \cos. n t.$$

This was deduced by a method of approximation devised to suit this particular case, and very similar in its application to Cauchy's method. It was hardly thought worth while to make a rigorous adjustment of the 49 conditional equations involved, because this curve fits the observations passably well. There are 22 above, 25 below, and 2 on the line.

In order to apply the method of least squares, and to test whether there are periodic terms depending on the sines and cosines of multiple angles of sufficient magnitude to influence the curve within the limit of errors of observation, a still further contraction of the above values was made. Taking the means of successive groups of four and allowing them equal weight we have the following mean dates and values of the latitude:

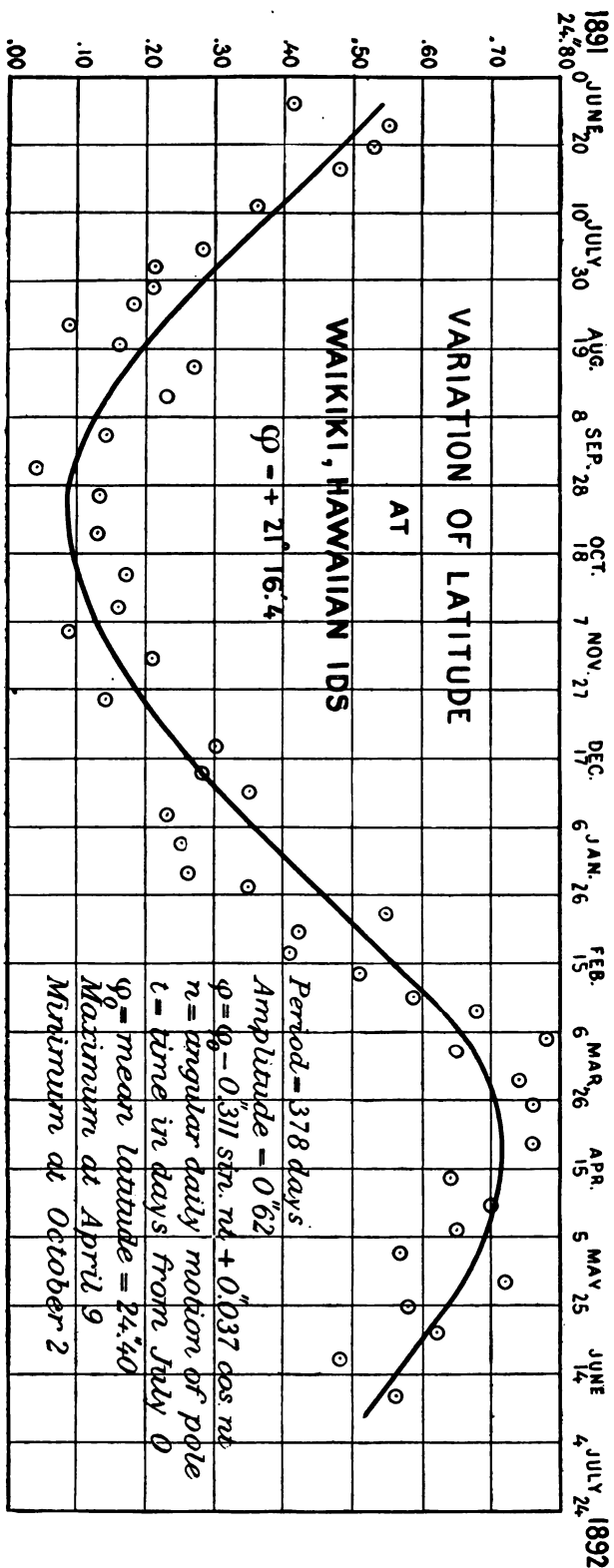
Date.	Latitude.	Date.	Latitude.
1891	"	1892	"
June 18	24.492	Jan. 7	24.272
July 22	.265	Feb. 3	.432
Aug. 15	.175	Feb. 27	.640
Sept. 17	.135	Mar. 24	.728
Oct. 28	.138	May 3	.656
Dec. 5	.232	June 7	.560

According to Fourier's theorem

$$f(\varphi) = X + h_1 \sin (a_1 + \varphi) + h_2 \sin (a_2 + 2\varphi) + h_3 \sin (a_3 + 3\varphi) + \text{etc.}$$

Substituting the above values of the latitude for $f(\varphi)$, the mean value plus a small correction (x) for X , and putting the angular value of φ in degrees for φ at the different dates counted from July 0, 1891, on the supposition of a period of 381 days, we have 12 conditional equations, of which the first is:

$$\begin{aligned} +.098 = & x + h_1 \sin a_1 \cos 349^\circ + h_1 \cos a_1 \sin 349^\circ \\ & + h_2 \sin a_2 \cos 338^\circ + h_2 \cos a_2 \sin 338^\circ \\ & + h_3 \sin a_3 \cos 327^\circ + h_3 \cos a_3 \sin 327^\circ \end{aligned}$$



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When the numerical values for the trigonometrical functions are employed and we use y for $h \sin a$ and z for $h \cos a$ the equations take the following form:

$$\begin{aligned}
 & +.098 = x + .982y_1 - .191z_1 + .927y_2 - .375z_2 + .839y_3 - .545z_3 \\
 & -.129 = x + .934 + .358 + .743 + .669 + .454 + .891 \\
 & -.219 = x + .731 + .682 + .070 + .998 - .629 + .777 \\
 & -.259 = x + .459 + .966 - .866 + .500 - .707 - .707 \\
 & -.256 = x - .391 + .920 - .695 - .719 + .934 - .358 \\
 & -.162 = x - .857 + .515 + .469 - .883 + .052 + .999 \\
 & -.122 = x - 1.000 .000 + 1.000 .000 - 1.000 .000 \\
 & +.038 = x - .809 - .438 + .616 + .788 - .208 - .978 \\
 & +.246 = x - .656 - .755 - .139 + .990 + .839 - .545 \\
 & +.334 = x - .292 - .956 - .829 + .559 + .777 + .629 \\
 & +.262 = x + .358 - .934 - .743 - .669 - .891 + .454 \\
 & +.166 = x + .809 - .588 + .309 - .951 - .309 - .951
 \end{aligned}$$

From these the following normal equations are derived:

$$\begin{array}{rcccccccc}
 x & y_1 & z_1 & y_2 & z_2 & y_3 & z_3 & = & l \\
 +12 & -.022 & -.421 & +.826 & +.907 & +.151 & -.334 & -0.003 \\
 & +6.43 & +.451 & +.064 & -.374 & +.036 & +.413 & +0.045 \\
 & & +5.57 & +.043 & -.082 & -.494 & +.828 & -1.648 \\
 & & & +5.60 & -.040 & -.264 & -.137 & -0.248 \\
 & & & & +6.40 & +.280 & +.237 & -0.017 \\
 & & & & & +5.92 & -.199 & +0.393 \\
 & & & & & & +6.08 & -0.225
 \end{array}$$

The diagonal coefficients are so much superior to any of the sides that the indirect method of elimination* can be readily applied, and we have, accurately enough for our purpose, the following values:

$$\begin{array}{ll}
 x = -.008 & z_1 = -.006 \\
 y_1 = +.028 & y_2 = +.040 \\
 z_1 = -.295 & z_2 = +.001 \\
 y_2 = -.039 &
 \end{array}$$

Substituting these we get

$$\begin{array}{ll}
 a_1 = 174 \ 35 & h_1 = +.297 \\
 a_2 = 81 \ 15 & h_2 = -.039 \\
 a_3 = 88 \ 34 & h_3 = +.040
 \end{array}$$

The substitution of the above quantities in the 12 conditional equations gives the following residuals:

$$\begin{array}{ll}
 0.024 & 0.007 \\
 .027 & .020 \\
 .003 & .017 \\
 .022 & .007 \\
 .032 & .013 \\
 .032 & .003
 \end{array}$$

If m = the number of equations and
 μ = the number of constants to be determined,

* Die Ausgleichungsrechnungen, etc., von Gerling, p. 386.

the probable error of one determination is

$$0.675 \sqrt{\frac{[vv]}{m-\mu}}$$

from the above residuals we get $r = \pm 0.''021$

Substituting the values of the constants in Fourier's theorem

$$\begin{aligned} f(\varphi) = & 24.386 + 0.297 \sin (174.35 + \varphi) \\ & - .039 \sin (81.15 + 2\varphi) \\ & + .040 \sin (88.34 + 3\varphi) \end{aligned}$$

and the formula becomes

$$\begin{aligned} \text{Latitude} = & 24.386 + 0.028 \cos \varphi - 0.297 \sin \varphi \\ & - .039 \cos 2\varphi - .006 \sin 2\varphi \\ & + .040 \cos 3\varphi + .001 \sin 3\varphi. \end{aligned}$$

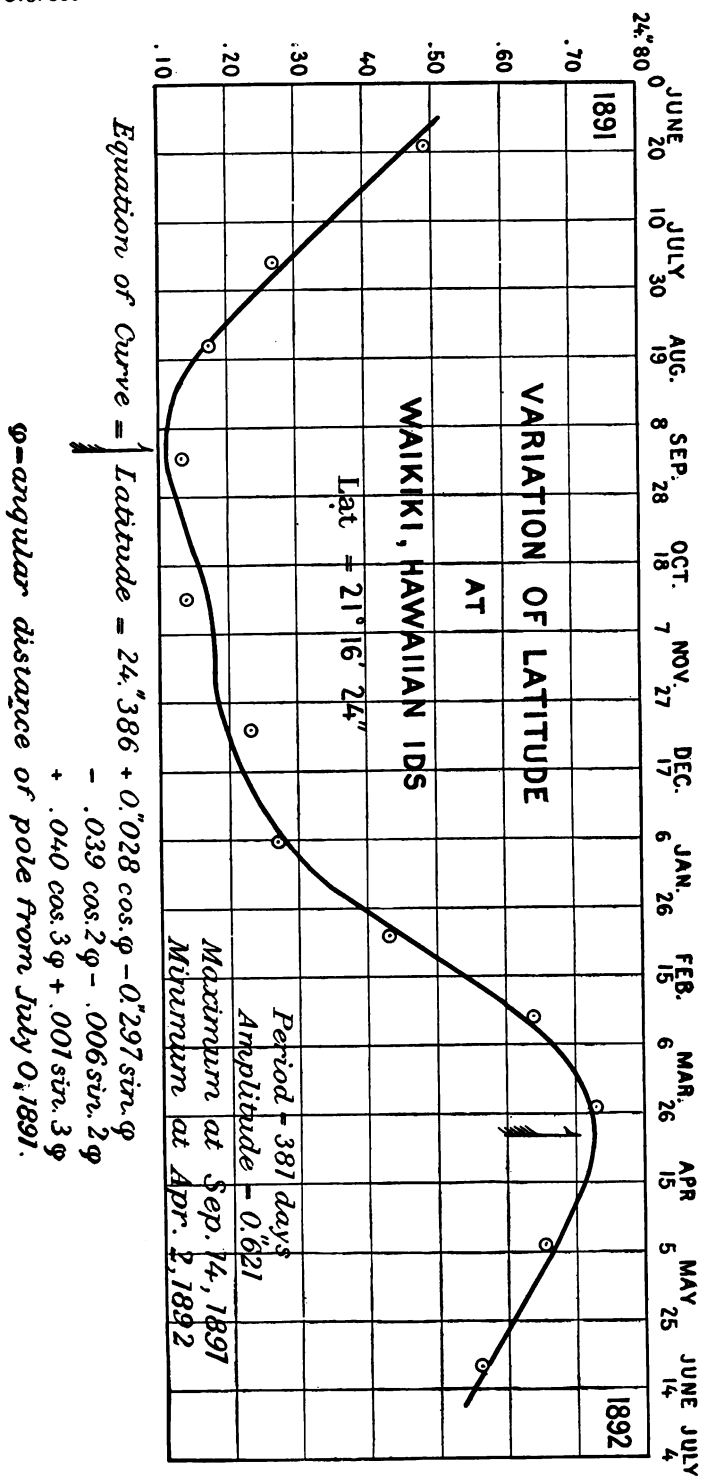
This equation is shown graphically in illustration No. 16 as well as the observational values from which it was derived.

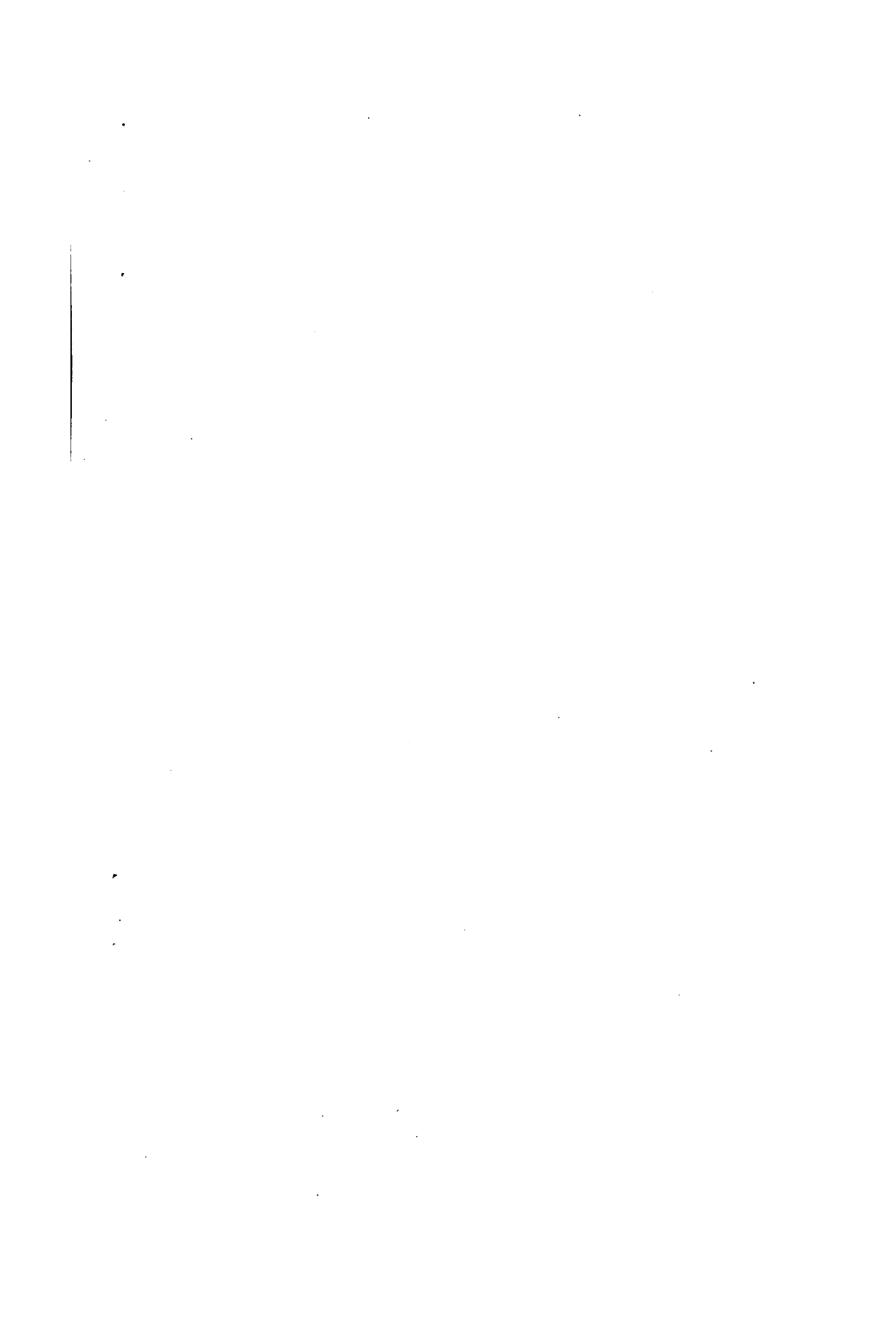
The first differential coefficient becomes zero at 71.4° and at 261.3° . Hence there is a minimum at September 14, 1891, and a maximum at April 2, 1892. The amplitude is $0.''621$.

Of course a still closer agreement could be made by using the quadruple angle and so on until we should arrive at the number of conditional equations. Just how far this approximation must be carried in order to bring out the real facts of the case can only be determined by appealing to the observations themselves. Some light is thrown on the subject by noting the concordance between theory and observation for successive applications of multiple angles. To this end are shown in illustrations No. 17 and No. 18 the curves for equations depending on the single and double angles, and also a superposition of one over the other for the sake of direct comparison.

In the adjustment by least squares, when we have arrived at such a point that the probable error of one of the conditional equations is practically equal to that calculated independently from the errors of observation and declination, we may safely conclude that a sufficient number of constants have been employed, and that all facts have been brought out which the accuracy of the observation warrants.

In the present case we have the following criterion. From the 61 pairs of stars used, the average probable error of a declination is $0.''257$ and that of the mean of two declinations would be $0.''181$. The probable error of observation as already given is $0.''155$, so that the result of one determination of latitude would be subject to an error of $\sqrt{0.181^2 + 0.155^2}$ or $0.''238$. Each one of the latitudes used in forming the conditional equations is the result of combining about 200 individual determinations, so that we should expect, since the precision increases





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as the square root of the number of observations, a probable error of 0."017 for each one of these collective results. As a matter of fact the least square work gives 0."021 for this quantity, so that we may consider that the constants employed are sufficient and necessary to express the observations. The use of the triple angle is therefore justified, and the introduction of constants terminates here.

Before closing, it should be added that the difference of about 0."5 between the determinations of Dr. Marcuse and my own is due to two causes: the position of the observatories and the adopted star places. The Coast and Geodetic Survey observatory was 0."3 south of that of the International Association (see illustration No. 11), and the declinations deduced by Mr. Farquhar for the Bradley-Auwers stars account for the remainder.



